CIVIL ENGINEERING

(For the batches admitted from the academic year 2022-23)

Vision

- To produce civil engineers with high technical competencies having value based professional and leadership qualities.

Mission

- To Impart quality education along with practice-based learning with ethical values.
- To impart knowledge in latest technologies and to develop highly competent professionals
- To promote quality education and research for industrial and societal needs.

Institutional Objectives

- To create a conducive and competitive environment for students through curricular and extra-curricular activities.
- Promote the culture of research among the faculty.
- To promote synergetic alliances with premier Institutions, Industry, CSIR laboratories and various Government organizations for Collaborative Research Projects.
- To promote economic and social enrichment of the society through Skill Development programmes, Entrepreneurship, and extension activities.
- To introduce demand-driven new UG&PG academic programmes.
- To ensure a high degree of quality in terms of providing infrastructure, research ambience, faculty and staff development.

Core Values

- *Thirst for Quality Education:* The stake holders of the institute particularly management, employees and students of the institution have a consistent thirst for quality improvement of the processes and services in the institution.
- *Lifelong Learning:* In the fast-changing technological world, acquiring a special skill at one point of time will not be enough for ever long survival. Hence to flourish in the workplace and to bring in innovations in the ways of doing, employee, student as well as alumni must be continuous learners and tech savvy.
- *Diversity and Participation:* PBRVITS promotes the involvement of faculty, staff, and students from all social, economic, ethnics, cultural and religious backgrounds

to get the synergy of combining the diversified agents. The focus is on involving students to exhibit their talent in various curricular and co-curricular activities and strengthening alumni link to share their experiences to the students.

- *Academic Integrity and Accountability:* Management induces accountability in the employees for the career of the students and the academic leadership establishes a mentoring mechanism for realization of responsibilities of students towards their parents and in turn to the society.

CIVIL ENGINEERING

(For the batches admitted from the academic year 2022-23)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept./Branch & Innovations

Semester I (First Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110101	Calculus and Special Functions	3	0	0	3	30	70	100
2	ES	21A050302	C Programming & Data Structures	3	0	0	3	30	70	100
3	ES	21A010301	Applied Mechanics	3	0	0	3	30	70	100
4	ES	21A030301	Engineering Drawing	1	0	4	3	30	70	100
5	ES	21A020303	Basic Electrical & Electronics engineering	3	0	0	3	30	70	100
6	HSMC	21A110201	Communicative English Lab	0	0	2	1	30	70	100
7	ES	21A050303	C Programming & Data Structures Lab	0	0	3	1.5	30	70	100
8	ES	21A020304	Basic Electrical & Electronics engineering Lab	0	0	3	1.5	30	70	100
Total							**19**			**800**

Semester II (First Year)

S. No	Category	Course Code	Course Title	Hours per week L	T	P	Credits C	CIE	SEE	Total
1	BS	21A110103	Differential Equations & Vector Calculus	3	0	0	3	30	70	100
2	BS	21A110106	Engineering Physics	3	0	0	3	30	70	100
3	BS	21A110107	Engineering Chemistry	3	0	0	3	30	70	100
4	HSMC	21A110202	English for Professionals	2	0	0	2	30	70	100
5	ES	21A010302	Building Materials, Construction and Planning	3	0	0	3	30	70	100
6	BS	21A110109A	Engineering Physics Lab	0	0	3	1.5	30	70	100
7	BS	21A110109B	Engineering Chemistry Lab	0	0	3	1.5	30	70	100
8	ES	21A010303	Basic Civil Engineering Lab	0	0	3	1.5	30	70	100
9	ES	21A050301	Engineering & IT Workshop Lab	0	0	3	1.5	30	70	100
10	MC	21A000001	Environmental Science	2	0	0	0	30	-	-
Total							**20**			**900**

Semester-III (Second Year)

S. No	Category	Course Code	Course Title	Hours per week L	T	P	Credits C	CIE	SEE	Total
1	BS	21A110102	Mathematical Methods	3	0	0	3	30	70	100
2	HSMC	21A110203	Managerial Economics & Financial Analysis	3	0	0	3	30	70	100
3	ES	21A010304	Strength of Materials	3	0	0	3	30	70	100
4	PC	21A010401	Fluid Mechanics and Hydraulic Machines	3	0	0	3	30	70	100
5	PC	21A010402	Surveying	3	0	0	3	30	70	100
6	ES	21A010305	Strength of Materials Lab	0	0	3	1.5	30	70	100
7	PC	21A010403	Fluid Mechanics and Hydraulic Machines Lab	0	0	3	1.5	30	70	100
8	PC	21A010404	Surveying Field Work	0	0	3	1.5	30	70	100
9	SC	21A010701	Building Drawing	1	0	2	2	30	70	100
10	MC	21A000002	Constitution of India	2	0	0	0	30	-	-
Total							**21.5**			**900**

Semester-IV (Second Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110110	Probability and Statistics	3	0	0	3	30	70	100
2	PC	21A010405	Concrete Technology	3	0	0	3	30	70	100
3	PC	21A010406	Advanced Strength of Materials	3	0	0	3	30	70	100
4	PC	21A010407	Engineering Geology	3	0	0	3	30	70	100
5	PC	21A010408	Structural Analysis-I	3	0	0	3	30	70	100
6	PC	21A010409	Engineering Geology Lab	0	0	3	1.5	30	70	100
7	PC	21A010410	Concrete Technology Lab	0	0	3	1.5	30	70	100
8	PC	21A010411	Computer Aided Civil Engineering drawing	0	0	3	1.5	30	70	100
9	SC	21A050701	Python Programming	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship-I (Community Service Project) during semester break										

Semester-V (Third Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A010412	Design of Reinforced concrete structures	3	0	0	3	30	70	100
2	PC	21A010413	Geotechnical Engineering	3	0	0	3	30	70	100
3	PC	21A010414	Structural Analysis- II	3	0	0	3	30	70	100
4	PE-I	21A010415 21A010416 21A010417	**Professional Elective – I** a) Water resources Engineering b) Green Buildings c) Advanced Surveying	3	0	0	3	30	70	100
5	OE-I		**Open Elective – I**	3	0	0	3	30	70	100
6	PC	21A010418	Computer Aided Design Lab	0	0	3	1.5	30	70	100
7	PC	21A010419	Geotechnical Engineering Lab	0	0	3	1.5	30	70	100
8	SC	21A010702	Advanced Surveying Lab	1	0	2	2	30	70	100
9	MC	21A000003	Universal Human Values	3	0	0	3	30	70	100
10	PROJ	21A010601	Internship-I Evaluation	-	-	-	1.5	-	-	100
Total							**24.5**			**1000**

Semester-VI (Third Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A010420	Design of Steel Structures	3	0	0	3	30	70	100
2	PC	21A010421	Transportation Engineering	3	0	0	3	30	70	100
3	PC	21A010422	Environmental Engineering	3	0	0	3	30	70	100
4	PE-II	21A010423 21A010424 21A010425	**Professional Elective – II** a) Foundation Engineering b) Railway, Airport & Harbor Engineering c) Rehabilitation & Retrofitting of Structures	3	0	0	3	30	70	100
5	OE-II		**Open Elective - II**	3	0	0	3	30	70	100
6	PC	21A010426	Environmental Engineering Lab	0	0	3	1.5	30	70	100
7	PC	21A010427	Transportation Engineering Lab	0	0	3	1.5	30	70	100
8	PC	21A010428	BIM using REVIT Architecture	0	0	3	1.5	30	70	100
9	SC	21A010703	Estimation, Costing and Valuation	1	0	2	2	30	70	100
10	MC	21A000004	Research Methodology	2	0	0	0	30	---	---
Total							**21.5**			**900**
Internship-II (Industry) during semester break)										

Semester-VII (Fourth Year)

S. No	Category	Course Code	Course Title	Hours per week L	T	P	Credits C	CIE	SEE	Total
1	PE-III	21A010429 21A010430 21A010431	**Professional Elective – III** a) Bridge Engineering b) Finite Element Methods in Civil Engineering Applications c) Design & Drawing of Irrigation Structures	3	0	0	3	30	70	100
2	PE-IV	21A010432 21A010433 21A010434	**Professional Elective – IV** a) Building Construction Management b) Ground Improvement Techniques c) Environmental Impact Assessment and Management	3	0	0	3	30	70	100
3	PE-V	21A010435 21A010436 21A010437	**Professional Elective – V** a) Advanced RCC Structural Design b) Advanced Foundation Engineering c) Pre stressed Concrete	3	0	0	3	30	70	100
4	OE-III		**Open Elective – III**	3	0	0	3	30	70	100
5	OE-IV		**Open Elective – IV**	3	0	0	3	30	70	100
6	HSMC	21A110204	Management Science	3	0	0	3	30	70	100
7	SC	21A030704	Project Management Lab	1	0	2	2	30	70	100
8	PROJ	21A010602	Internship-II Evaluation	-	-	-	3	-	-	100
			Total				**23**			**800**

Semester-VIII (Fourth Year)

S. No	Category	Course Code	Course Title	Hours per week L	T	P	Credits C	CIE	SEE	Total
1	PROJ	21A010603	Full Internship & Major Project	-	-	12	10	110	140	250
2	PROJ	21A010604	Technical Seminar	-	-	4	2	50	-	50
			Total				**12**			**300**

Open Elective – I

S. No	Course Code	Course Title
1	21A020501	Electric Vehicles
2	21A020502	Electrical Distribution Systems
3	21A030501	Robotics
4	21A030502	Basics of Mechanical Engineering
5	21A040501	Integrated Circuits and Applications
6	21A040502	Introduction to Signal Processing
7	21A050501	Operating Systems Concepts
8	21A050502	Computer Architecture & Organization

Open Elective – II

S. No	Course Code	Course Title
1	21A020503	Smart Grid
2	21A020504	Energy Storage Systems
3	21A030503	Automation in Industries
4	21A030504	Rapid Prototyping
5	21A040503	Principles of Communication Systems
6	21A040504	Electronic Instrumentation
7	21A050503	Java Programming
8	21A050504	Basics of Database Management Systems

Open Elective – III

S. No	Course Code	Course Title
1	21A020505	Renewable Energy Systems
2	21A020506	Concepts of Electrical Drives and Applications
3	21A030505	Optimization Techniques
4	21A030506	Global Warming and Climate Changes
5	21A040505	Electronic Sensors
6	21A040506	Introduction to Image Processing
7	21A050505	Introduction to Internet of Things
8	21A050506	Web Technologies for Beginners

Open Elective – IV

S. No	Course Code	Course Title
1	21A020507	Energy Conservation and Management
2	21A020508	Basics of Power Electronics
3	21A030507	Basics of Automotive Engineering
4	21A030508	Basics of Total Quality Management
5	21A040507	Principles of Cellular and Mobile Communications
6	21A040508	Embedded Systems
7	21A050507	Cloud Computing – AWS
8	21A050508	Basics of Cryptography & Network Security

COURSES OFFERED FOR HONOURS DEGREE IN CE

S. No	Course Code	Course Title	Hours per week		Credits	CIE	SEE	Total
			L	T	C			
1	21A01HN01	Traffic Engineering	3	1	4	30	70	100
2	21A01HN02	Remote Sensing and Global Positioning Systems	3	1	4	30	70	100
3	21A01HN03	Pavement Analysis and Design	3	1	4	30	70	100
4	21A01HN04	Road Safety Engineering	3	1	4	30	70	100
5	21A01HN05	MOOC – 1	-	-	2	-	-	-
6	21A01HN06	MOOC – 2	-	-	2	-	-	-

LIST OF MINORS OFFERED TO CE

S. No	Course Code	Course Title	Department offering the course
1	21A040402	Pulse and Digital Circuits	ECE
2	21A040415	Data Communication and Networking	ECE
3	21A040433	Biomedical Signal Processing	ECE
4	21A040434	Radar Engineering	ECE
5	21A050415	Design and Analysis of Algorithms	CSE & ALLIED
6	21A050418	Mobile Computing	CSE & ALLIED
7	21A310402	Artificial Intelligence and Neural Networks	CSE & ALLIED
8	21A350401	Sensors and Internet of Things	CSE & ALLIED

Course Code	CALCULUS AND SPECIAL FUNCTIONS (Common to all branches)		L	T	P	C
21A110101			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course will illuminate the students in the concepts of calculus and Mean value theorems.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Utilize mean value theorems to real life problems.

CO2: Familiarize with functions of several variables which is useful in optimization.

CO3: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems.

CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 3- dimensional coordinate systems.

CO5: Utilize special functions in evaluating definite integrals.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (10 Hrs)

Mean Value Theorems: Rolle’s Theorem, Lagrange’s mean value theorem, Cauchy’s mean value theorem, Taylor’s and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as series of Taylor’s and Maclaurin’s with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT – II (12 Hrs)

Multi variable calculus: Partial derivatives, total derivatives, chain rule, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes: At the end of this unit, students should be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

UNIT – III (10 Hrs)

Double Integrals: Evaluation of Double integrals, change of order of integration, change of variables. Areas using Double Integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

UNIT – IV (10 Hrs)

Triple Integrals: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volumes using triple integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate triple integrals in Cartesian, cylindrical and spherical polar coordinates. (L5)
- Apply triple integration techniques in evaluating volumes. (L4)

UNIT – V (12 Hrs)

Beta and Gamma functions: Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B.S. Grewal, Khanna Publishers, 44/e, 2017.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.
2. "Calculus", George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
3. "Advanced Modern Engineering Mathematics", Glyn James, Pearson publishers, 4/e, 2011.
4. "Advanced Engineering Mathematics", Michael Greenberg, Pearson Education, 9th Edition.
5. "Advanced Engineering Mathematics with MATLAB", Dean G. Duffy, CRC Press
6. "Advanced Engineering Mathematics", Peter O'Neil, Cengage Learning.
7. "Engineering Mathematics Volumes-I &II", R.L. Garg Nishu Gupta, Pearson Education
8. "Higher Engineering Mathematics", B. V. Ramana, McGraw Hill Education
9. "Higher Engineering Mathematics", H. K. Das, Er. Rajnish Verma, S. Chand & Co. Ltd.
10. "Advanced Engineering Mathematics", N. Bali, M. Goyal, C. Watkins, Infinity Science Press.
11. "Engineering Mathematics", T.K.V Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications.

Course Code	C-PROGRAMMING & DATA STRUCTURES (Common to all branches)		L	T	P	C
21A050302			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- Demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C using Arrays and Strings.
CO3: Modularize the problem and also solution.
CO4: Design applications in C using Functions, Pointers, and Structures.
CO5: Explore various operations on Stacks, Queues and Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Computer Fundamentals, Algorithm, Flowchart.

Introduction to C Language: Characteristics, Identifiers, Constants, Data types, Keywords, Basic input/output statements, Structure of a C program.

Operators and Expressions: Operators classification, Assignment Operator, Arithmetic Operators, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators with examples – Operator precedence and Associativity, Type casting.

Statements: Simple and Compound statements, Control Statements - Conditional/Decision statements, Loop Control Statements, Branch Control statements.

Learning Outcomes: At the end of this unit, students should be able to

- Solve complex problems using language independent notations (L3)
- Use C basic concepts to write simple C programs (L3)
- Test and execute the programs and correct syntax and logical errors (L4)
- Select the control structure for solving the problem (L4)
- Implement conditional branching, iterations (L2)

UNIT-II (12 Hrs)

Arrays: Declarations, Initialization and accessing elements, Single, Two and Multi-dimensional arrays.

Array Techniques: Array order reversal, finding the maximum and minimum number in a set, sorting the given array elements.

Strings: String I/O functions, String handling functions, Data conversion functions.

Learning Outcomes: At the end of this unit, students should be able to

- Use arrays to process multiple homogeneous data (L3)
- Solve mathematical problems using C Programming languages (L3)
- Apply string handling functions (L3)

UNIT-III (12 Hrs)

Functions: Types of functions, Library functions, User-defined functions, Function Categories, Nested functions, Recursion, Symbolic constants, Pre-processor Commands, Storage classes – auto, register, static, extern, Type qualifiers.

Input and output: Standard input and output, Non-formatted Input and Output statements, Formatted Input and Output statements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of modular programming (L2)
- Apply modular approach for solving the problem (L3)
- Writing C programs using various storage classes to control variable access (L5)
- Apply input and output statements to process the data in various formats (L3)

UNIT-IV (12 Hrs)

Pointers: Pointers and addresses, Passing parameters to functions, Address Arithmetic operations, Void and Null pointers, Pointer and Arrays, Pointer and Strings, Array of Pointers, Pointer and Functions, Pointer-to-Pointer, Dynamic Memory Allocation. Uses of Pointers, Command line Arguments.

Structure and Union: Declaration and Initialization of a structure, Copy and comparisons, Array of structures, Structure with pointer, Nested structures, Type Definition, Enumeration, Union.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Structure the individual data elements to simplify the solutions (L6)
- Facilitate efficient memory utilization (L6)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT-V (14 Hrs)

Data Structures: Overview of data structures, **Stack:** Representation of a stack, Operations and Applications of a Stack – Evaluation of Arithmetic Expressions, Implementation of Recursion – **Queue:** Representation of a queue, Operations and Applications of a Queue – CPU Scheduling in Multi-programming Environment.

Linked List: Representations of linked lists, singly linked list, doubly linked list, Circular linked list and its operations.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Describe the operations of a stack (L2)
- Develop various operations on Queues (L6)
- Analyze various operations on singly linked list (L4)
- Interpret operations of doubly linked lists (L2)
- Apply various operations on Circular linked lists (L6)

TEXTBOOKS:

1. "The Complete Reference C", Herbert Schildt, McGraw Hill Education, Fourth Edition
2. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
3. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition
2. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

Course Code	APPLIED MECHANICS		L	T	P	C
21A010301			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.
- Understand Moment of force, Varignon's theorem with applications, couple.
- To learn the effect of friction on equilibrium.
- To learn kinematics, kinetics of particle and rigid body, related principles.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
CO2: Analyze the forces in the members of the frames/truss.
CO3: Apply the concept of friction and its applications.
CO4: Determine centroid and location of centroid of plane figures and material bodies.
CO5: Evaluate moment of inertia of plane figures and material bodies.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	3	-	-	-	-	-	2	2
CO2	2	3	3	1	1	-	-	-	-	-	-	-	2	2
CO3	3	3	2	1	1	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	1	-	-	-	-	-	-	-	1	1
CO5	3	2	3	2	2	-	-	-	-	-	-	-	1	1

UNIT-I (16 Hours)

Introduction to Engineering Mechanics: Basic concepts - System of forces–Resultant and Equilibrium of system forces, free body diagrams for coplanar concurrent and non concurrent system of forces, Moment of forces and its Application & Couples, Spatial Forces-Components in space, Resultant and equilibrium

Types of Supports: Support reactions for beams with different types of loading – concentrated, uniformly distributed load, uniformly varying loading and couple.

Learning Outcomes: At the end of this unit, students should be able to

- Use scalar and vector analytical techniques for analyzing forces (L4)
- Calculate the resultant of system of forces. (L3)
- Demonstrate the actions and reactions with free body diagram and apply conditions of equilibrium (L2)

UNIT- II (12 Hours)

Analysis of Perfect Frames: Types of frames – Analysis of frames using method of joints, and methods ofsections for vertical loads, horizontal loads and inclined loads.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze for the forces in the members of the truss by method of joints (L4)
- Identify the type of frame and analyze for the forces in the members of the truss (frame) by method of sections. (L4)

UNIT-III (12 Hrs)

Friction: Types of friction– Static and Dynamic Frictions, laws of Friction–Limiting friction and impending motions–Cone of limiting friction– Motion of bodies – Ladder Friction.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of friction(L2)
- Analyze various types of friction. (L2)
- Apply types of motions and also understand, applications of friction. (L3)

UNIT-IV (15Hrs)

Centroid and Centre of Gravity: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies -Centre of Gravity of Composite figures. (Simple problems only).
Moment of Inertia: Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures. Moment of Inertia of Simple solids

Learning Outcomes: At the end of this unit, students should be able to

- Understand distributed force systems, centroid center of gravity and method of finding centroids of composite figures and bodies. (L2).
- Analyze various types of problems related to Moment of Inertia (L2)

UNIT-V (12 Hrs)

Kinematics: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of A Rigid Body

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation & Fixed Axis Rotation

Learning Outcomes: At the end of this unit, students should be able to

- Understand practical examples related to curvilinear motion. (L2)
- Relate kinematics with kinetic equations on linear displacement, velocity and acceleration. (L4)
- Understand Kinetics of rigid body rotation. (L2)

TEXTBOOKS:

1. "Engineering Mechanics", S. Timoshenko, D. H. Young and J. V. Rao, 5th Edition, Tata McGraw Hill Company
2. "Engineering Mechanics", R.K Bansal, 6th Edition, Laxmi Publications
3. "Engineering Mechanics", Bhavikatti, 8th Edition, New Age International Private Limited
4. "The Engineering Mechanics: Statics and Dynamic Series", Hibbeler, 14th Edition, Pearson Publications

REFERENCE BOOKS:

1. "Engineering Mechanics-Statics and Dynamics", A. Nelson, 1st Edition, Tata McGraw Hill Company.
2. "Engineering Mechanics", Ferdinand L. Singer, 3rd Edition, Harper Collings Publishers

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/122104025
2. https://archive.nptel.ac.in/courses/112/106/112106286

Course Code	ENGINEERING DRAWING (Common to all branches)		L	T	P	C
21A030301			1	0	4	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.
- Instruct graphical representation of machine components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Construction of various conic curves, Cycloid curves

CO2: Construction of projections of Points, Lines applied in engineering

CO3: Construction of projections of Planes.

CO4: Construction of projection of solids development of surfaces regular Solids.

CO5: Representation of Ortho and Isometric views of solids.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO4	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO5	3	2	2	-	3	-	-	-	-	2	-	2	2	2

UNIT-I (12 Hrs)

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance - Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, Epi-cycloid and Hypocycloid - general method only.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of engineering drawing (L2)
- Know the conventions used in the engineering drawing (L1)
- Identify the curves obtained in different conic sections (L2)

- Draw different cycloidal curves. (L3)

UNIT– II (12 Hrs)

Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, true angle made by line.

Learning Outcomes: At the end of this unit, students should be able to

- Know how to draw the projections of points, lines (L1)
- Find the true length of the lines. (L2)

UNIT-III (18 Hrs)

Projection of planes: Projections of regular plane inclined to both the planes and also draw the projections of different planes in Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of planes. (L2)
- Draw the projection of plane inclined to one plane and both the planes. (L3)
- Understand the different commands used in Computerized drawing to draw different planes. (L2)

UNIT- IV (15 Hrs)

Projections of solids: Projections of regular solids inclined to one or both planes by rotational method.

Development of Solids: Development of lateral Surfaces of Right Regular Solids(without section)-Prism, Cylinder, Pyramid, Cone.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of solids. (L2)
- Draw the projection of solid inclined to one plane. (L3)
- Draw the projection of solids inclined to both the planes. (L3)

UNIT–V (18 Hrs)

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Conversion of Isometric Views to Orthographic Views. Drawing the Isometric views using Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the basics convectional representation of different projections (L1)
- Draw the Orthographic projection of simple solids. (L3)

- Draw the Isometric projection of simple solids. (L3)

TEXTBOOKS:

1. “Engineering Drawing”, K. L. Narayana & P. Kannaiah, SciTech Publishers, Chennai, 3/e.
2. “Engineering Drawing + AutoCAD”, K. Venugopal, V. Prabhu Raja, New Age Publishers.
3. “Engineering Drawing”, N. D. Bhatt, Charotar Publishers, 53/e, 2016

REFERENCE BOOKS:

1. “Engineering Drawing”, Dhanajay A Jolhe, Tata McGraw-Hill, Copy Right, 2009.
2. “Engineering Drawing”, Basant Agarwal & C. M. Agarwal, Tata McGraw-Hill
3. “Engineering Drawing”, Shah and Rana, Pearson Education, 2/e, 2009

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A020303			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To teach DC and AC electrical circuit analysis
- To explain working principles of transformers and electrical machines
- To impart knowledge on Power system generation, transmission and distribution
- Familiar with the theory, construction, and operation of electronic devices
- Learn about biasing of BJTs and FETs.
- Design and construct amplifiers, understand the concept & principles of logic devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply concepts of KVL/KCL in solving DC circuits

CO2: Illustrate working principles of DC Motor, Transformer and Induction motors

CO3: Understand the basics of Power generation, Transmission and Distribution

CO4: Explain the theory, construction, operation and working of electronic devices.

CO5: Analyze and design small signal amplifier circuits, logic gate, combinational and sequential circuits

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

Part A: Basic Electrical Engineering

UNIT-I (10 Hrs)

DC & AC Circuits: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms -peak and rms values - phasor representation - real power - reactive power - apparent power – power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

Learning Outcomes: At the end of this unit, students should be able to

- Recall Kirchoff laws (L1)

- Analyze simple electric circuits with DC excitation (L4)
- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations (L4)

UNIT- II (10 Hours)

DC & AC Machines: Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator –principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single-Phase Transformer - OC and SC tests on transformer -Principle and operation of 3-phase AC machines [Elementary treatment only]

Learning Outcomes: At the end of this unit, students should be able to

- Explain principle and operation of DC Generator & Motor. (L2)
- Perform speed control of DC Motor (L3)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor - DC motor (L2)

UNIT-III (12 Hrs)

Basics of Power Systems: Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary& Secondary distribution systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand working operation of various generating stations (L1)
- Explain the types of Transmission and Distribution systems (L2)

TEXTBOOKS:

1. “Basic Electrical Engineering”, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2010.
2. “Principles of Power System”, V.K. Mehta & Rohit Mehta, S. Chand, 2018.

REFERENCE BOOKS:

1. “Fundamentals of Electrical Engineering”, L. S. Bobrow, Oxford University Press, 2011.
2. “Electrical and Electronics Technology”, E. Hughes, Pearson, 2010.
3. “Generation Distribution and Utilization of Electrical Energy”, C.L. Wadhwa, New Age International Publications, 3rd Edition.

Part 'B'- Electronics Engineering

UNIT-I (10 Hrs)

Diodes and Applications: Semiconductor Diode, Diode as a Switch& Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications of Zener Diode, LED, Photo Diode.

Transistor Characteristics: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Biasing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

Learning outcomes: At the end of this unit, students should be able to

- Remember and understand the basic characteristics of semiconductor diode. (L1)
- Understand principle of operation of Zener diode and other special semiconductor diodes (L1)
- Analyze BJT based biasing circuits. (L3)
- Design an amplifier using BJT based on the given specifications. (L4)

UNIT-II (10 Hrs)

Operational Amplifiers and Applications: Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

Learning outcomes: At the end of this unit, students should be able to

- Describe operation of Op-Amp based linear application circuits, converters, amplifiers and non-linear circuits. (L2)
- Analyze Op-Amp based comparator, differentiator and integrator circuits. (L3)

UNIT-III (10 Hrs)

Digital Electronics: Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder. Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters.

Learning outcomes: At the end of this unit, students should be able to

- Explain the functionality of logic gates. (L2)
- Apply basic laws and De Morgan's theorems to simplify Boolean expressions. (L3) Analyze standard combinational and sequential circuits. (L4)

TEXTBOOKS:

1. "Electronic Devices & Circuit Theory", R. L. Boylestad & Louis Nashlesky, Pearson Education, 2007.
2. "Op-Amps & Linear ICs", Ramakanth A. Gayakwad, Pearson, 4th Edition, 2017.
3. "Modern Digital Electronics", R. P. Jain, Tata Mcgraw Hill, 3rd Edition, 2003.
4. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2nd Edition, 2012.

REFERENCE BOOKS:

1. "Basic Electronics - Devices, Circuits and IT Fundamentals", Santiram Kal, Prentice Hall of India, 2002.
2. "A Text Book of Electronic Devices and Circuits", R. S. Sedha, S.Chand & Co, 2010.
3. "Introductory Electronic Devices & Circuits - Conventional Flow Version", R. T. Paynter, Pearson Education, 2009.

Course Code	COMMUNICATIVE ENGLISH LAB		L	T	P	C
21A110201	(Common to all branches)		0	0	2	1
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with special emphasis on Listening and Speaking skills.
- To equip students with professional skills & soft skills, Develop communication skills in formal and informal situations
- To help students present themselves confidently during Group Discussions and Oral Presentations

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use creativity in listening to formal and informal conversations.
CO2: Analyze the concepts of active listening and barriers to listening.
CO3: Communicate effectively in everyday life using right oral expressions.
CO4: Acquire the confidence to present themselves effectively during academic and professional presentations.
CO5: Acquire basic knowledge of non-verbal communication and its importance.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	3	-	-	-	-	-

UNIT-I (6 Hrs)

Essentials of Listening: Purpose of Listening, Listening to Conversation (Formal and Informal), Active Listening- an Effective Listening Skill, Barriers to Listening, Listening to Announcements-(railway/ bus stations/ airport /sports announcement/commentaries etc.)

Learning Outcomes: At the end of this unit, students should be able to

- Know the difference between hearing and listening. (L2)
- Understand the purpose of active listening. (L2)
- Follow the announcements through focused listening. (L2)

UNIT-II (6 Hrs)

Listening Comprehension: Academic Listening (Listening to Lectures), Listening to Short Talks and Listening to Presentations, Note Taking Tips

Learning Outcomes: At the end of this unit, students should be able to

- Comprehend different academic lectures. (L3)
- Take notes while listening to short talks and lectures. (L3)
- Improve comprehension skills through listening to short talks and presentations. (L3)

UNIT-III (6 Hrs)

Communicating in everyday life: Asking for and giving information, Offering and responding to offers, Requesting and responding to requests, Congratulating people on their success, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving,

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate expressions to communicate in everyday life. (L3)
- Communicate effectively in different contexts of conversations. (L3)
- Participate in role plays and situational dialogues with an exposure to social and professional contexts. (L3)

UNIT- IV (6 Hrs)

Presentation Skills: Giving Short Talks, Preparing power point presentation, Greeting and Introducing in presentations, Presenting a paper, Participating in group discussions (dos & don'ts)

Learning Outcomes: At the end of this unit, students should be able to

- Prepare a power point presentation effectively. (L3)
- Present a paper in a seminar. (L3)
- Participate in Group Discussions efficiently. (L3)

UNIT-V (6 Hrs)

Non-verbal Communication: Personal Appearance, Gestures, Postures, Facial Expression, Eye Contact, Body Language (Kinesics), Silence, Tips for Improving Non-Verbal Communication

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of body language in communication (L2)
- Improve non-verbal communication skills (L3)
- Understand how body language and non-verbal communication affects the personality of an individual in a social and professional set-up. (L2)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://learnenglish.britishcouncil.org/skills/listening
2. https://agendaweb.org/listening/comprehension-exercises.html
3. https://www.123listening.com/
4. https://www.linguahouse.com/learning-english/skill-4-learners/listening
5. https://www.talkenglish.com/listening/listen.aspx
6. https://ed.ted.co

Course Code	C-PROGRAMMING & DATA STRUCTURES LAB (Common to all branches)		L	T	P	C
21A050303			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of C Programming
- To make the student solve problems, implement algorithms using C language
- To design programs using arrays, strings, pointers and structures
- To design Stack and Queue operations
- To apply different operations o linked lists

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Demonstrate the basic concepts of C programming language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs using functions, arrays, structures and pointers.
CO4: Illustrate the concepts Stacks and Queues.
CO5: Design operations on Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

Week 1

a) Write a C program to swap the given two integer values without using temporary variable.
b) Write a C program to print the first 'N' Fibonacci sequence numbers.

Week 2

a) Write a C program to print reverse of a given integer value.
b) Write a C program to find the roots of a quadratic equation.

Week 3

Write a C program that use recursive functions.

i) GCD of given two values.
ii) Factorial of a given value.

Week 4

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program to perform the following:

i) Addition of Two matrices ii) Multiplication of Two matrices

Week 5

a) Write a C program that displays the position or index in the string S where the string T begins or -1 if S doesn't contain T.

b) Write a C program to read a set of strings and sort them in alphabetical order.

Week 6

a) Write a C program to count number of alphabets, digits and special symbols of a given line.

b) Write a C program to check whether a given string is palindrome or not.

Week 7

Write a C program to demonstrate the difference between call-by-value and call-by-address mechanisms.

Week 8

Write a program to perform the operations addition, subtraction, multiplication of complex numbers.

Week 9

Write a C program that implement stack operations using arrays.

Week 10

a) Write a C program that implement linear queue operations using arrays.

b) Write a C program that implement circular queue operations using arrays.

Week 11

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on doubly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following operations on circular linked list.
i) Creation ii) Insertion iii) Deletion iv) Traversal

TEXTBOOKS:

1. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
2. "Computer Science: A Structured Programming Approach Using C", B.A. Forouzon and R.F. Gilberg, CENGAGE Learning, Third Edition, 2016.
3. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition,
2. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB		L	T	P	C
21A020304	(Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To Verify Kirchoff's laws and Superposition theorem
- To learn performance characteristics of DC Machines and 1- Phase Transformer
- To Study the I – V Characteristics of Solar PV Cell
- To analyze the characteristics of Diodes, BJT, MOSFET, UJT
- To design the amplifier circuits from the given specifications.
- Exposed to linear and digital integrated circuits

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Understand Kirchoff's Laws & Superposition theorem.

CO2: Analyze the various characteristics on 1-phase transformer and DC Machines by conducting various tests.

CO3: Analyze I – V Characteristics of PV Cell

CO4: Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.

CO5: Construct and analyze the various diode rectifiers, clippers and clampers and other circuits.

CO-PO MAPPING;

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

PART A: ELECTRICAL ENGINEERING

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.

6. Load test on 1-Phase Transformer.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

PART B: ELECTRONICS ENGINEERING

List of Experiments:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Full Wave Rectifier with & without filter.
4. Wave Shaping Circuits. (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration.
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting amplifiers using Op-AMPs.
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
9. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs all the required active devices

Note: Minimum of Six Experiments to be performed in each section.

Course Code	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to CE, EEE & ECE)		L	T	P	C
21A110103			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve the differential equations related to various engineering fields.
CO2: Apply a range of techniques to find solutions of standard PDEs.
CO3: Identify solution methods for partial differential equations that model physical Processes.
CO4: Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO5: Estimate the work done against a field, circulation and flux using vector calculus.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	3	-	-	-	-	-	-	-	1	-	-
CO5	2	3	2	2	-	-	-	-	-	-	-	1	-	-

UNIT – I (13 Hrs)

Linear differential equations of higher order (Constant Coefficients): Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian method of variation of parameters. Simultaneous linear equations, Applications toL-C-R Circuit problems and Mass spring system.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the essential characteristics of linear differential equations with constant coefficients (L3)
- Solve the linear differential equations with constant coefficients by appropriate method (L3)
- Classify and interpret the solutions of linear differential equations (L3)

- Formulate and solve the higher order differential equation by analysing physical situations (L3)

UNIT– II (11 Hrs)

Partial Differential Equations: Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method.

Learning Outcomes: At the end of this unit, students should be able to

- Apply a range of techniques to find solutions of standard PDEs (L3)
- Outline the basic properties of standard PDEs (L2)

UNIT – III (12 Hrs)

Applications of Partial Differential Equations: Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation and Laplace's Equation.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the PDE (L3)
- Learn the applications of PDEs (L2)

UNIT– IV (13 Hrs)

Vector differentiation: Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes: At the end of this unit, students should be able to

- Apply del to Scalar and vector point functions (L3)
- Illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

UNIT – V (14 Hrs)

Vector integration: Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stroke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Learning Outcomes: At the end of this unit, students should be able to

- Find the work done in moving a particle along the path over a force field (L4)
- Evaluate the rates of fluid flow along and across curves (L4)
- Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

TEXTBOOKS:

1. “Advanced Engineering Mathematics”, Erwin Kreyszig, John Wiley & Sons,10/e, 2011.
2. “Higher Engineering Mathematics”, B.S. Grewal, Khanna publishers, 44/e, 2017.

REFERENCE BOOKS:

1. “Engineering Mathematics”, T. K. V Iyengar, Dr. B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications
2. “Advanced Engineering Mathematics”, Michael Greenberg, Pearson, 2/e, 2018
3. “Calculus”, George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
4. “Advanced Engineering Mathematics”, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.
5. “Advanced Modern Engineering Mathematics”, Glyn James, Pearson publishers, 4/e, 2011.
6. “Advanced Engineering Mathematics”, Michael Greenberg, Pearson edn, 9th Edition
7. “Advanced engineering mathematics with MATLAB”, Dean G. Duffy, CRC Press
8. “Advanced Engineering Mathematics”, Peter O’Neil, Cengage Learning.
9. “Engineering Mathematics Volumes-I &II”, R.L. Garg Nishu Gupta, Pearson Education
10. “Higher Engineering Mathematics”, B. V. Ramana, McGraw Hill Education.
11. “Higher Engineering Mathematics”, H. K Das, Er. Rajnish Verma, S. Chand.
12. “Advanced Engineering Mathematics”, N. Bali, M. Goyal, C. Watkins, Infinity Science Press.

Course Code	ENGINEERING PHYSICS		L	T	P	C
21A110106	(Common to CE, ME, CSE-IOT, CSE-AI, AIML)		3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To present the basic concepts needed to understand the crystal structure of materials, X- ray diffraction and the importance of nano materials.
- To understand the mechanisms of lasers and propagation of light through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To explain the significance of acoustics and ultrasound in different engineering fields.
- Evolution of band theory to distinguish materials and explain the properties of semiconductors.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Explain the important properties of crystals & structure determination using X-ray Diffraction along with the nano materials.
CO2: Identify the importance of lasers and fiber optics in different engineering fields
CO3: Understands the response of dielectric & magnetic materials to the applied electric & magnetic fields
CO4: Explain the basic concepts of acoustics and ultrasonics.
CO5: Elaborate the physical properties of semiconductors.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Crystallography & Nano materials

Crystallography: Introduction – Space lattice – Unit cell – Lattice parameters – Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Laue Method - Powder method.

Nano materials – Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Classify various crystal systems (L2)
- Identify different planes in the crystal structure (L3)
- Analyze the crystalline structure by Bragg's law to measure the crystallinity of a solid by powder method (L4)
- Identify the nano size dependent properties of nano materials (L2)
- Illustrate the methods for the synthesis and characterization of nano materials (L2)

UNIT - II (12 Hrs)

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Transmission of signals in step index and graded index fibers – Propagation Losses (qualitative) – Applications of fiber in medical field .

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

UNIT – III (12 Hrs)

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)

- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius - Mosotti relation in dielectrics (L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
- Explain the applications of dielectric and magnetic materials (L2)

UNIT - IV (13 Hrs)

Acoustics and Ultrasonics

Acoustics- Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine's formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

Ultrasonics- Introduction – Properties – Production by magneto striction and piezoelectric methods – Detection – Acoustic grating – Non Destructive Testing – Applications.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Explain how sound is propagated in buildings (L2)
- Analyze acoustic properties of typically used materials in buildings (L4)
- Recognize sound level disruptors and their use in architectural acoustics (L2)
- Identify the use of ultrasonics in different fields (L3)

UNIT - V (13 Hrs)

Semiconductors- Origin of energy bands - Classification of solids into conductors, semiconductors and insulators -Intrinsic and extrinsic semiconductors (Qualitative treatment)– Density of carriers and Fermi levels in intrinsic & extrinsic semiconductors Drift & diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)

TEXTBOOKS:

1. "Engineering Physics", Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, S. Chand and Company
2. "Engineering Physics", B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. "Engineering Physics", K. Thyagarajan, McGraw Hill Publishers

REFERENCE BOOKS:

1. "Engineering Physics", Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. "Engineering Physics", Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press

3. “Semiconductor physics and devices - Basic principles”, Donald A, Neamen, McGraw Hill
4. “Engineering physics”, P.K. Palanisamy, SCITECH Publications
5. “Applied Physics”, S. Mani Naidu, Pearson Publications
6. “Lasers and Non-Linear Optics”, B.B Laud, New Age International Publishers.

Course Code	ENGINEERING CHEMISTRY		L	T	P	C
21A110107	(Common to CE, ME)		3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard water, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers and advanced engineering materials

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the hardness of water through its softening techniques for domestically and industrially.

CO2: Apply the knowledge of various electrochemical cells for the development of new batteries and explain the reasons for corrosion and its control methods.

CO3: Differentiate the types of Plastomers and elastomers; apply the knowledge effective usage in daily life.

CO4: Explain the origin of fuel and their economic advantages.

CO5: Apply the knowledge of different modern materials used in engineering field.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1
CO2	3	-	-	-	2	-	-	-	-	-	-	-	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CO4	3	1	-	-	-	-	-	-	-	-	-	-	2	2
CO5	3	2	-	-	2	-	-	-	-	-	-	-	1	1

UNIT-I (14 Hrs)

Water Technology: Introduction –Soft Water and hardness of water, Estimation of hardness of water by EDTA Method –Boiler troubles–Priming, foaming, sludge and scale, Caustic embrittlement, Industrial waste water treatment specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO)standards, ion-exchange processes-desalination of brackish water, reverse osmosis (RO) and electro dialysis.

Learning Outcomes: At the end of this unit, students should be able to

- List the differences between temporary and permanent hardness of water(L1)
- Explain the principles of reverse osmosis and electro dialysis. (L2)
- Compare quality of drinking water with BIS and WHO standards. (L2)
- Illustrate problems associated with hard water – sludge and scale. (L2)

- Explain the working principles of different Industrial water treatment processes (L2)

UNIT-II (13 Hrs)

Electrochemistry and Applications: Electrodes–concepts, electrochemical cell, Nernst equation, cell potential calculations. Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (Ni-Cd),and lithium ion batteries-working of the batteries including cell reactions; Fuel cells-hydrogen-oxygen, methanol-oxygen fuel cells –working of the cells.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling-Bed worth ratios and uses, Factors affecting the corrosion, prevention of corrosion by cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Nernst equation for calculating electrode and cell potentials (L3)
- Apply Pilling-Bedworth rule for corrosion and corrosion prevention (L3)
- Demonstrate the corrosion prevention methods and factors affecting corrosion (L2)
- Compare different batteries and their applications (L2)

UNIT-III (13 Hrs)

Polymers: Introduction to polymers, functionality of monomers, Classification of polymerization. Plastomers - Thermoplastics and Thermo-setting plastics- Preparation, properties and applications of poly styrene, PVC and Bakelite.

Elastomers: Natural rubber, Processing of natural rubber, vulcanization, compounding of rubber. Synthetic rubber: Preparation, properties and applications of Buna-S, Buna-N and Thiokol rubber.

Learning Outcomes: At the end of this unit, students should be able to

- Explain different types of polymers and their applications (L2)

UNIT-IV (10 Hrs)

Fuel Technology: Fuels – classification and their characteristics**,** calorific value - units, Solid fuels – Coal – classification, Analysis of coal, Liquid Fuels- refining of petroleum, Synthetic petrol: Bergius process, Fischer-Troph's process. Fuels for IC engines, knocking and anti-knocking agents, Octane and Cetane numbers, Gaseous Fuels- Flue gas analysis by Orsat's apparatus.

Learning Outcomes: At the end of this unit, students should be able to

- Select suitable fuels for IC engines (L3)
- Explain calorific values, octane number, refining of petroleum (L2)

UNIT-V (10 Hrs)

Modern Engineering Materials: Nano material's: Introduction, classification, properties and applications of fullerenes, carbon nanotubes and Graphene nanoparticles.

Refractories: Classification, Properties, Factors affecting the refractory materials and Applications.

Lubricants-Classification, Functions of lubricants, Mechanism, Properties of lubricating oils–Viscosity, Viscosity Index, Flashpoint, and Fire point, Cloud point, saponification of oil and Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate the applications of fullerenes, carbon nanotubes and Graphene nanoparticles (L2)
- Identify the factors affecting the refractory material (L3)
- Illustrate the functions and properties of lubricants (L2)

TEXTBOOKS:

1. "Engineering Chemistry", Jain and Jain, Dhanpat Rai publications,17/e, 2018.
2. "A textbook of Engineering Chemistry" Dr. SS Dara, Dr. SS Umare, S. Chand publications, 12/e, 2010.
3. "A textbook of Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2010.

REFERENCE BOOKS:

1. "Concise Inorganic Chemistry", J. D. Lee, Oxford University Press, 5/e, 2008
2. "Engineering Chemistry", G. V. Subba Reddy, K. N. Jayaveera and Ramachandraiah, McGraw Hill, 2020.

Course Code	ENGLISH FOR PROFESSIONALS		L	T	P	C
21A110202	(Common to all branches)		2	0	0	2
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To improve Reading and Writing proficiency of students in English with an emphasis on Vocabulary development.
- To provide knowledge of grammatical structures and encourage their appropriate use in writing.
- To improve students' comprehension skills required for academic and professional needs.
- To equip students with writing skills required for professional correspondence in different contexts.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate word knowledge and its usage in appropriate contexts.
CO2: Recognize and incorporate basic grammar mechanics and sentence variety in writing.
CO3: Improve comprehension skills through intensive and extensive reading practice.
CO4: Learn and apply various writing formats for effective communication.
CO5: Improve writing skills needed for professional correspondence in various contexts.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

UNIT-I (10 Hrs)

Vocabulary Building: Introduction to affixes and base words, Prefixes and suffixes, Basic comparing and contrasting, Idioms and Phrases, One word substitutes, Words often confused, Synonyms and Antonyms used in the everyday contexts, Using prior knowledge to determine the correct word for the context, Discovering the correct word in the sentence by looking at the surrounding words, Vocabulary in social interactions.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize word parts: affixes, prefixes, suffixes and base words. (L2)
- Use words appropriately in a context. (L3)
- Guess the meanings of the words by using the contextual clues. (L2)
- Use synonyms, antonyms, phrases and idioms in writing. (L2)

UNIT-II (10 Hrs)

Essentials of Sentence Formation: Basic Sentence Structure, word order, Subject-Verb Concord, Using Tenses, Punctuation Marks, Correction of Common Errors

Learning Outcomes: At the end of this unit, students should be able to

- Frame a sentence without any grammatical errors. (L3)
- Use appropriate punctuation marks. (L3)
- Identify common errors in a sentence. (L2)

UNIT-III (10 Hrs)

Reading Comprehension: Understanding short real-world notices, messages, factual material - Scanning, skimming - Inferring meaning - Critical reading - Reading and information transfer

Learning Outcomes: At the end of this unit, students should be able to

- Use skimming and scanning strategies while reading. (L3)
- Infer meaning from the given text. (L3)
- Distinguish between the main idea and supporting ideas. (L3)
- Critically analyse the given text. (L4)

UNIT-IV (10 Hrs)

Writing Skills: Rules for good writing and composition; Paragraph Writing: Structure of a paragraph, Types of paragraphs, Usage of Cohesive Devices; Essay writing: Structure of an Essay, Types of Essays; Letter Writing (Formal and informal): Format and Structure; and Email writing

Learning Outcomes: At the end of this unit, students should be able to

- Learn to organize thoughts into meaningful paragraphs. (L2)
- Use cohesive devices in making the piece of writing more coherent. (L3)
- Compose essays on different topics in a more organised structure. (L3)
- Draft letter and emails in a definite format. (L3)

UNIT-V (10 Hrs)

Professional Correspondence: Internal Correspondences – Memorandum, Note Taking, Minutes of Meetings; External Correspondences - Business Letters - Cover Letters - Sale Letters - Inquiry Letters - Complaint Letters - Emails & Netiquette

Learning Outcomes: At the end of this unit, students should be able to

- Draft official e-mails and letters for different professional purposes. (L3)
- Write proficiently memos and minutes of meeting. (L3)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://digital.library.upenn.edu/women/sultana/dream/dream.html
2. https://owl.purdue.edu/
3. https://www.thesaurus.com/
4. https://www.readwritethink.org/classroom-resources/student-interactives
5. https://www.fluentu.com/blog/english/english-writing-websites/

Course Code	BUILDING MATERIALS, CONSTRUCTION AND PLANNING		L	T	P	C
21A010302			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To impart knowledge on basic building materials such as stone and clay products.
- To explain basic concepts of building components
- To describe applications of plumbing, electrical and sanitary fittings.
- To explain the methodology of surface finishes such as pointing, distempering and painting.
- To impart knowledge on building planning, building bye laws and regulations

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Assess the properties of stones, Bricks, Tiles and sand.
CO2: Analyze the properties of Cement, Plastics, glass and characteristics of steel, as building materials.
CO3: Formulate the construction procedure of staircases and various types of floorings.
CO4: Apply the building bye laws and regulations.
CO5: Propose the planning of various types of buildings.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	2	2	-	-	-	-	1	-	-
CO2	3	2	3	-	-	2	2	-	-	-	-	1	-	-
CO3	3	-	3	-	2	2	2	-	-	-	-	1	-	1
CO4	3	-	3	-	-	2	2	2	-	-	-	-	2	-
CO5	3	-	3	2	1	2	2	2	-	-	-	-	2	-

UNIT – I (10 Hrs)

Stones, Bricks, Timber, Tiles and Sand

Properties and characteristics of Basic building materials – Stones –characteristics of good building stones-types of stone masonry - bricks –characteristics of good quality bricks-manufacturing of bricks-types of bonds in brick work-Timber-Characteristics of good timber, defects and seasoning of timber, tiles-types of tiles- sand –sources of sand – properties of sand.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of building material in civil engineering. (L2)
- Identify the characteristics of basic building material used (L3).
- Construct different types of bonds in masonry work (L3).
- Identify the characteristics of good qualities of timber and the defects (L3).
- Assess the qualities of sand to be used in construction work (L5).

UNIT – II (12 Hrs)

Cement, Steel, Plastics and Glass

Cement: Raw materials used, Chemical composition, Process of Manufacturing, - Types of cement – Uses of cement. Steel –characteristics of reinforcing steel – Hardness, Tension & Compression. Plastics: classification, advantages of plastics, Mechanical properties and use of plastic in construction, Glass: Ingredients, properties, types and use in construction.

Learning Outcomes: At the end of this unit, students should be able to

- Understand manufacturing of cement, types and their uses (L2)
- Identify the characteristics of reinforcing steel, their properties and applications(L2).
- Apply the properties and applications of glass and plastics in construction of structures(L2)

UNIT – III (12 Hrs)

Basics of Building Components:

Components of building, area considerations, Construction Principle and Methods for layout, stair cases and their types. Different types of floors, and flooring materials. Doors and Windows: Construction details, types of doors and windows and their relative advantages & disadvantages. Types of roof – Lintels and Chajjas. Plastering and its types, Colour washing, Painting

Learning Outcomes: At the end of this unit, students should be able to

- Apply the principles of construction for various building components (L2)
- Apply the advantages of types of doors & windows in a building (L4).
- Demonstrate various properties and applications of Plastering (L4).
- Understand about Colour washing and painting (L2).

UNIT – IV (8 Hrs)

PLANING OF BUILDINGS:

Types of buildings, types of residential buildings, site selection for residential building, orientation of buildings; aspect; prospect; privacy; furniture requirement; grouping; circulation; sanitation; lighting; ventilation; cleanliness; flexibility; elegancy; Economy; practical considerations.

BUILDING BYELAWS AND REGULATIONS:

Introduction- Terminology ;Objectives of building byelaws; Minimum plot sizes; Open space requirements ;Plinth area, floor area, carpet area; Floor area ratio (FAR), Floor space Index (FSI) ;areas for different units; Principles underlying building byelaws ; built up area limitations – Height of Buildings ,Wall thickness, lighting and ventilation requirement, safety from fire, drainage and sanitation; applicability of the bye-laws.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the planning requirements like site selection, orientation , lighting , ventilation of a building (L5)
- Understand about various building bye laws and regulations (L2).
- Acquire knowledge on practical considerations in planning of a building (L2).

UNIT – V (8 Hrs)

PLANNING OF VARIOUS TYPES OF BUILDINGS:

Minimum standards for various parts of buildings – requirements of different rooms and their grouping – characteristics of various types of residential buildings, Educational institutions, Hospitals, Office

SIGN CONVENTIONS

Brick, Stone, Plaster, Sand filling, Concrete, Glass, Steel, Cast iron, Copper alloys, Aluminum alloys etc., Lead, Zinc, tin, and white lead etc., Earth, Rock, Timber and Marble.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the minimum standards to be followed for planning of different types of buildings (L2)
- Asses the requirements of different types of buildings (L5).
- Categorize different elements by assigning sign convention (L4).

TEXTBOOKS (For Building Materials & Construction):

1. SK Duggal, “Building Materials” New Age International
2. BC Punmia, “Building Construction” Laxmi Publication.
3. G.C Sahu and Joygopal Jena, “Building materials and construction”, Mc Graw Hill Education

REFERENCE BOOKS:

1. PC Varghese, “Building Materials” PHI
2. Mehta, “Building Construction Principles, Materials & Systems” 2/e, Pearson Education Noida.
3. Sandeep Mantri, “Practical building Construction and its Management” Satya Publisher, New Delhi.
4. Adams, “Adams’ Building Construction Adams” CRC Press Taylor & Francis Group.

TEXTBOOKS (For Building Planning and Design):

1. Planning and Designing and Scheduling – Gurucharan Singh and Jagadish Singh, Standard publishers.
2. Building planning and design – N. Kumara swamy and A. Kameswara rao, Charitor publications.

REFERENCE BOOKS:

1. Building bye laws by state and Central Governments and Municipal corporations.
2. National Building Code – 2016.

ONLINE LEARNING RESOURCES:

1. https://engineeringvideolectures.com/course/285
2. https://www.nptelvideos.com/course.php?id=285

Course Code	ENGINEERING PHYSICS LAB		L	T	P	C
21A110109A	(Common to CE, ME, CSE-IOT, CSE-AI, AIML)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its application in finding the wavelength.
- Understands the concepts of interference, diffraction and their applications.
- Verify the Laws of Stretched Strings by sonometer.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Operate various optical instruments

CO2: Estimate wavelength of laser using laser

CO3: Evaluate the acceptance angle of an optical fiber and numerical aperture

CO4: Plot the intensity of the magnetic field of circular coil carrying current with distance

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	-

LIST OF EXPERIMENTS

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of wavelength of LASER light using diffraction grating.
5. Determination of numerical aperture and acceptance angle of a given optical fiber
6. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
7. Sonometer: Verification of the three laws of stretched strings
8. Determination of particle size using LASER.
9. Study the variation of B versus H by magnetizing the magnetic material. (B-H curve)
10. Determination of rigidity modulus of material of a wire -dynamic method. (Torsional Pendulum)

REFERENCE BOOKS:

1. "A Textbook of Practical Physics", S. Balasubramanian, M.N. Srinivasan, S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Code	ENGINEERING CHEMISTRY LAB		L	T	P	C
21A110109B	(Common to CE, ME)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of Engineering Chemistry.
- To verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop skills in determining the effects of hardness of water.
CO2: Distinguish different types of titrations in the volumetric analysis.
CO3: Determine the cell constant and conductance of solutions.
CO4: Analyze the effect of temperature on viscosity by using Redwood viscometer.
CO5: Prepare advanced polymer Thiokol rubber materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	1	-
CO5	3	2	-	-	1	-	-	-	-	-	-	-	2	-

LIST OF EXPERIMENTS:

1. Preparation of standard Magnesium sulphate solution
2. Determination of Total Hardness of Ground Water by EDTA Titration Method
3. Determination of Strength of an acid in Lead-Acid battery
4. Conductometry- Determination of cell constant and conductance of solutions.
5. Potentiometry- determination of redox potentials and emf's
6. PH-metric titration of a) strong acid vs strong base b) weak acid vs strong base
7. Determination of the rate of corrosion in Iron sample
8. Determination of percentage moister content in a Coal sample.
9. Determination of Viscosity of lubricating oil by Redwood Viscometer No-I&II
10. Determination of calorific value of gases by Junker's gas calorimeter
11. Preparation of Thiokol rubber.
12. Preparation of nanomaterial's

TEXTBOOKS:

1. “Engineering Chemistry”, Shashi Chawla, Dhanpat Rai publications, 2/e, 2014.
2. “Experiments in Applied Chemistry”, Dr. Sunita Rattan, S. K. Kataria & Sons Publishers of Engineering, 2/e, 2004.

REFERENCE BOOKS:

1. “Vogel’s Text Book of Quantitative Chemical Analysis”, Mendham J et.al, Pearson Education, 6/e, 2012.

Course Code	BASIC CIVIL ENGINEERING LAB		L	T	P	C
21A010303			0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize with the basics of civil engineering construction works

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Familiarize with setting out a building using tape and cross staff
CO2: Understand the process of construction of masonry work
CO3: Familiarize with plumbing and painting works in a structure
CO4: Prepare the building blocks using low-cost material

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	-	-	2	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO4	3	3	2	2	2	-	-	-	-	-	-	-	1	1

LIST OF EXPERIMENTS:

1. Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape only.
2. Setting out of a building: The student should set out a building (single room only) as per the given building plan using tape and cross staff.
3. Construct a wall of height 50 cm and wall thickness 1½ bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm.
4. Construct a wall of height 50 cm and wall thickness 2 bricks using English bond (No mortar required) - corner portion – length of side walls 60 cm.
5. Computation of Centre of gravity and Moment of inertia of a given rolled steel section by actual measurements.
6. Installation of plumbing and fixtures like Tap, T-Joint, Elbow, Bend, Threading etc;
7. Plastering and finishing of wall
8. Application of wall putty and painting a wall
9. Application of base coat and laying of Tile flooring of one square meter
10. Preparation of soil cement blocks for masonry and testing for compressive strength
11. Casting and testing of Fly ash Blocks
12. Preparation of cover blocks for providing cover to reinforcement

REFERENCE BOOKS:

1. "Workshop Technology", HS Bawa, Tata Mcgraw Hill Publishers, New Delhi.
2. "Workshop Technology", B.S. Raghuwanshi, Dhanpat Rai And Co., New Delhi
3. "Basic Workshop Practice Manual", T Jeyapoovan, Vikas Publishing House (P) Ltd., New Delhi
4. "Manual On Workshop Practice", K Venkata Reddy, Macmillan India Ltd., New Delhi

Course Code	ENGINEERING & IT WORKSHOP LAB		L	T	P	C
21A050301	(Common to all branches)		0	0	3	1.5
Pre-requisite	NIL	Semester	II			

PART-A (ENGINEERING WORKSHOP)

COURSE OBJECTIVES:

- To familiarize the students with wood working, sheet metal operations, fitting and electrical house, Wiring and foundry skills.
- To provide technical training to the students on Word, Excel and Presentation.
- To make the students know about the internal parts of a computer.
- To learn how to use Internet facility for Browsing and Searching.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply wood working skills and build different parts with metal sheets in real world applications.
CO2: Apply fitting operations in various applications and Preparation of moulds and castings.
CO3: Apply different types of basic electric circuit connections.
CO4: Prepare documentation, spread sheets for calculations and slides for Presentation.
CO5: Identify Computer peripherals and its functions, Internet browsing to obtain the required information

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	1	-
CO2	3	2	2	-	-	2	-	-	-	-	-	2	1	-
CO3	3	2	-	-	-	2	-	-	-	-	-	2	1	2
CO4	3	-	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

LIST OF TOPICS:

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint b) Dovetail joint or Bridle joint

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Square fit.

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting

Foundry:

a) Preparation of mould cavity using single piece pattern.
b) Preparation of mould cavity using split piece pattern

PART-B (IT WORKSHOP)

LIST OF TOPICS:

Task 1:

MS-Word: Students should be able to create documents using the word processor tool. Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit report.

Task 2:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 3:

Presentations: creating, opening, saving the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, running the slide show.

Task 4: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 5:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.

REFERENCE BOOKS:

1. "Workshop Practice Manual", K. Venkata Reddy, BS Publications.
2. "Engineering work shop practice for JNTU", V. Ramesh babu, VRB Publishers Pvt. Ltd., 2009.
3. "Work shop manual", P. Kannaiah, K. L. Narayana, SCITECH Publishers.
4. "Engineering practices lab manual", Jeyapoovan, Saravanapandian, Vikas Publishing House, 4/E
5. "Dictionary of mechanical engineering", GHF Nayler, Jaico Publishing House.
6. "Introduction to Computers", Peter Norton, McGraw Hill
7. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox.
8. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
9. "Networking your computers and devices", Rusen, Prentice Hall of India
10. "Bigelow's Trouble shooting, Maintaining & Repairing PCs", Bigelow, Tata McGraw Hill Edition

Course Code	ENVIRONMENTAL SCIENCE		L	T	P	C
21A000001	(Common to CE, ME, EEE, ECE, CSE, CSE-IOT)		2	0	0	0
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo- chemical cycles and ecological pyramids.

CO3: Understand various causes of pollution and solid waste management and related preventive measures.

CO4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5: Casus of population explosion, value education and welfare programmes.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO2	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO3	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO5	-	-	-	-	-	1	2	1	-	-	-	1	-	-

UNIT – I (10 Hrs)

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance, Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associatedproblems–Forestresources–Useandover–exploitation,deforestation,casestudies - Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of public awareness (L1)
- Know about the various resources (L1)

UNIT–II (10 Hrs)

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes: At the end of this unit, students should be able to

- Know about various echo systems and their characteristics (L1)
- Know about the biodiversity and its conservation (L1)

UNIT – III (10 Hrs)

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the various sources of pollution. (L1)
- Know about the various sources of solid waste and preventive measures. (L1)

- Know about the different types of disasters and their managerial measures. (L1)

UNIT- IV (10 Hrs)

Social Issues and The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, water shed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the social issues related to environment and their protection acts. (L1)
- Know about the various sources of conservation of natural resources. (L1)
- Know about the wild life protection and forest conservation acts. (L1)

UNIT – V (10 Hrs)

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the population explosion and family welfare programmes. (L1)
- Identify the natural assets and related case studies. (L1)

TEXTBOOKS:

1. "Text book of Environmental Studies for Undergraduate Courses", Erach Bharucha for University Grants Commission, Universities Press.
2. "Environmental Studies", Palani swamy, Pearson education
3. "Environmental Studies", S. Azeem Unnisa, Academic Publishing Company
4. "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", K. Raghavan Nambiar, SCITECH Publications (India), Pvt. Ltd.

REFERENCE BOOKS:

1. "Textbook of Environmental Science", Deeksha Dave and E. Sai Baba Reddy, Cengage Publications.
2. "Text book of Environmental Sciences and Technology", M. Anji Reddy, BS Publication.
3. "Comprehensive Environmental studies", J. P. Sharma, Laxmi publications.
4. "Environmental Sciences and Engineering", J. Glynn Henry and Gary W. Heinke, Prentice Hall of India Private limited
5. "A Text Book of Environmental Studies", G. R. Chatwal, Himalaya Publishing House
6. "Introduction to Environmental Engineering and Science", Gilbert M. Masters and Wendell P. Ela, Prentice Hall of India Private limited.

Course Code	MATHEMATICAL METHODS (Common to all branches)		L	T	P	C
21A110102			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- This course aims at providing use of matrix algebra techniques for practical applications.
- This course aims at providing the student with the knowledge on Various numerical Methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Interpret the use of matrix algebra techniques that is needed by engineers for practical applications. **(K2)**

CO2: Illustrate and solve the roots of equation using Bisection method, Iterative method, Regula- Falsi method, Newton Raphson method and solve the system of algebraic equations. **(K3)**

CO3: Apply concept of interpolation and derive interpolating polynomial using Newton's forward and backward formulae, Lagrange's formulae, Gauss forward and backward formulae. **(K3)**

CO4: Evaluate initial value problems to ordinary differential equations. **(K5)**

CO5: Determine the process of finding integral equations using Simson's 1/3, Simson's 3/8 Rule and Trapezoidal rule and fitting a best curve using least squares method. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1	-

UNIT – I (10 Hrs)

Matrices: Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their Properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Diagonalization of a matrix.

Learning Outcomes: At the end of this unit, students should be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT - II (9 Hrs)

Solution of Algebraic & Transcendental Equations: Introduction-Bisection method-Iterative method-Regula-Falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan Method-Gauss Seidal method.

Learning outcomes: At the end of this unit, students should be able to

- Calculate the roots of equation using Bisection method and Iterative method. (L3)
- Calculate the roots of equation using Regula-Falsi method and Newton Raphson method. (L3)
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Seidal method. (L3)

UNIT – III (9 Hrs)

Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of interpolation. (L2)
- Derive interpolating polynomial using Newton's forward and backward formulae. (L3)
- Derive interpolating polynomial using Lagrange's formulae. (L3)
- Derive interpolating polynomial using Gauss forward and backward formulae. (L3)

UNIT – IV (8 Hrs)

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations- Euler's Method - Modified Euler's Method-Runge-Kutta Methods.

Learning Outcomes: At the end of this unit, students should be able to

- Solve initial value problems to ordinary differential equations using Taylor's method. (L3)
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods. (L3)

UNIT – V (9 Hrs)

Numerical Integration & Curve Fitting:

Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Fitting of straight line – second degree curve –Exponential curve –Power curve by the method of least squares.

Learning Outcomes: At the end of this unit, students should be able to

- Fit a best curve using method of least squares. (L3)
- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule. (L3)
- Solve integral equations using Trapezoidal rule. (L3)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna publishers.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India
3. "Introductory Methods of Numerical Analysis", S. S. Sastry, PHI publishers.

REFERENCE BOOKS:

1. "Higher Engineering Mathematics", B. V. Ramana, Mc Graw Hill publishers.
2. "Advanced Engineering Mathematics", Alan Jeffrey, Elsevier Publishers
3. "A Text Book of Engineering Mathematics Vol – I", T.K.V. Iyengar, B. Krishna Gandhi, S. Chand & Company.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/111107098

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all branches)		L	T	P	C
21A110203			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To know the various types of Market Structures & pricing methods and its strategies.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

After completion of the course the student will be able to

CO1: Analyse the consumer behaviour with regard to their product or services and measure demand of a particular product or services by applying various methods in given situation **(K4)**

CO2: Determine Break Even Point (BEP) of an enterprise Assess the cost behaviour, costs useful for managerial decision making **(K3)**

CO3: Determine the price of a product or services in given market condition **(K3)**

CO4: Analyze the financial position by using different types of ratios and interpret the financial accounting **(K4)**

CO5: Evaluate the investment proposals under payback period, ARR, IRR, NPV & PI methods **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT – I (10 Hrs)

Introduction to Managerial Economics and Demand Analysis: Managerial Economics–Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand- Demand Forecasting-Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Learning Outcomes: At the end of this unit, students should be able to

- Know the nature and scope of Managerial Economics and its importance. (L1)
- Understand the concept of demand and its determinants. (L2)
- Analyse the elasticity and degree of elasticity. (L4)
- Evaluate demand forecasting methods. (L5)
- Design the process of demand estimation for different types of demand. (L6)

UNIT – II (8 Hrs)

Theory of Production and Cost Analysis:

Production Function – Short-run and Long-run Production Function -Isoquants and Iso costs, MRTS –Least cost combination of Inputs, Cobb-Douglas Production Function - Laws of Returns – Internal and External Economies of scale – **Cost & Break-Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA)–Determination of Break-Even Point (Simple Problems)-Managerial significance of Break-Even Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, Input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)
- Develop Profit appropriation for different levels of business activity. (L6)

UNIT – III (8 Hrs)

Introduction to Markets and New Economic Environment:

Market structures Types of Markets-Perfect and Imperfect Competition- Features of Perfect Competition– Monopoly -Monopolistic Competition –Oligopoly-Price-Output Determination-Pricing Methods and Strategies- Forms of Business Organizations - Sole Proprietorship - Partnership – Joint Stock Companies-Public Sector Enterprises -. New economic Environment - **Economic Liberalization – Privatization – Globalization.**

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know the production function, input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)

UNIT – IV (12 Hrs)

Capital and Capital Budgeting: Concept of Capital-Significance-Types of Capital-Components of Working Capital - Sources of Short-term and Long-term Capital -Estimating Working capital requirements-**Capital Budgeting**–Features of Capital Budgeting Proposals – Methods and

Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept of Capital Budgeting and its importance in business (L1)
- Contrast and compare different investment appraisal methods. (L4)
- Analyse the process of selection of investment alternative using different appraisal methods. (L4)
- Evaluate methods of Capital budgeting techniques. (L5)
- Design different investment appraisals and make wise investments. (L6)

UNIT – V (7 Hours)

Introduction to Financial Accounting and Analysis: Financial Accounting – Concept – Emerging need and Importance - Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet (with simple adjustments). ***Financial Analysis* -** Ratios- Liquidity, Leverage, Profitability and Activity Ratios (Simple Problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept and convention and significance of accounting. (L1)
- Apply the fundamental knowledge of accounting while posting the Journal entries. (L3)
- Analyze the process and preparation of Financial Accounts and Financial Ratios. (L4)
- Evaluate the Financial performance of an enterprise by using financial statements. (L5)

TEXTBOOKS:

1. “Managerial Economics”, Varshney & Maheswari, S. Chand, 2013.
2. “Managerial Economics and Financial Analysis”, Aryasri, MGH, 4th Edition, 2019

REFERENCE BOOKS:

1. “Managerial economics”, Ahuja HL, S. Chand, 3rd Edition, 2013.
2. “Managerial Economics and Financial Analysis”, S. A. Siddiqui and A. S. Siddiqui, New Age International, 2013.
3. “Principles of Business Economics”, Joseph G. Nellis and David Parker, Pearson, 2nd Edition, New Delhi.
4. “Managerial Economics in a Global Economy”, Dominick Salvatore, Cengage Learning, 2013.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/110101005
2. https://nptel.ac.in/courses/110101149

Course Code	STRENGTH OF MATERIALS		L	T	P	C
21A010304			3	0	0	3
Pre-requisite	Applied Mechanics	Semester	III			

COURSE OBJECTIVES:

- To introduce the concepts of different stresses, strains and their relationships.
- To explain maximum shear force and bending moment of different beams under different loading conditions.
- To demonstrate bending stress distribution of various cross section of beams and to predict the maximum slope deflection of beams.
- To demonstrate shear stress distribution of various cross section of beams and to predict the maximum slope deflection of beams.
- To discuss the principal stresses and components of stress on different planes under different loads.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Calculate stresses, strains and deformations of basic geometries under axial loading and thermal effects. **(K4)**

CO2: Predict Shear Force and Bending Moment Diagrams for different types of beams and loading conditions. **(K2)**

CO3: Compute bending stresses in beams under different loading conditions. **(K3)**

CO4: Compute shear stresses in beams under different loading conditions. **(K3)**

CO5: Construct the Mohr's circle for calculating principal stresses and analyze principal stresses in biaxial state of loading. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	-	2	2
CO2	3	2	1	1	-	-	-	-	-	-	-	-	2	2
CO3	3	2	1	1	-	-	-	-	-	-	-	-	2	3
CO4	3	2	1	1	-	-	-	-	-	-	-	-	2	3
CO5	3	3	1	1	-	-	-	-	-	-	-	-	3	3

UNIT – I (10 Hrs)

Simple Stresses and Strains: Mechanical properties of materials, Types of stresses and strains, stress-strain diagram of ductile and brittle materials, poison's ratio, elastic constants and their relation, bars of uniform and varying sections, composite bars, thermal stresses, factor of safety. Strain energy: Introduction, strain energy in gradual, sudden and impact loading.

Learning Outcomes: At the end of this unit, students should be able to

- Determine stresses and deformations due to axial loads in simple members. (L3)
- Analyze stresses compound bars due to temperature raise. (L4)
- Classify the elastic constants of materials. (L3)
- Analyze strain energy for different types of loading. (L4)

UNIT – II (9 Hrs)

Shear Force and Bending Moment in Beams: Introduction, Types of beams, shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to point, uniformly distributed and uniformly varying loads, relation between Shear force and bending moment.

Learning Outcomes: At the end of this unit, students should be able to

- Determine the shear force and bending moment values in beams subjected to different types of loadings. (L3)
- Draw shear force and bending moment diagrams in beams subject to bending loading. (L3)
- Determine the point of contraflexure in overhanging beams. (L3)
- Evaluate the maximum shear force and bending moment and their location in beams.(L4)

UNIT – III (8 Hrs)

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/Y = E/R – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hallow), I, T, Angle and Channel Sections – Design of simple beam sections.

Learning Outcomes: At the end of this unit, students should be able to

- Determine bending stresses in beams under different loading. (L4)
- Compute the flexural stresses for different cross sections. (L3)
- Design beam sections for flexure. (L6)

UNIT – IV (9 Hrs)

Shear Stresses: Derivation of formula-Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections. Combined bending and shear.

Learning Outcomes: At the end of this unit, students should be able to

- Determine shear stresses for different shapes. (L3)
- Evaluate effect of combined bending and shear on sections(L5)

UNIT – V (9 Hrs)

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories of Failures: Various Theories of failures like Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

Learning Outcomes: At the end of this unit, students should be able to

- Choose critical planes in two-dimensional stress systems. (L5)
- Estimate principal stresses (L4)
- Assess safety of structural elements under principal stresses. (L6)
- Assess various theories of failures (L6)

TEXTBOOKS:

1. "A text book of strength of materials", Dr. R K Bansal, Lakshmi Publications, 3rd Edition, 2018
2. "Strength of materials", S.S. Rattan, Tata Mc Graw Hill Publications, 3rd Edition.

REFERENCE BOOKS:

1. "Mechanics of Materials", Beer and Johnson, Tata McGraw Hill publications, 8th Edition.
2. "Engineering Mechanics of Solids", Popov and Egor P., Prentice Hall India.
3. "Mechanics of materials", James M. Gere and Barry Goodier, CENGAGE Learning Custom Publishing, 9th Edition.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/112107146
2. https://nptel.ac.in/courses/105105108
3. https://nptel.ac.in/courses/112106141

Course Code	FLUID MECHANICS AND HYDRAULIC MACHINES		L	T	P	C
21A010401			3	0	0	3
Pre-requisite	Applied Mechanics	Semester	III			

COURSE OBJECTIVES:

- To impart ability to solve engineering problems in fluid mechanics
- To explain basics of statics, kinematics and dynamics of fluids and various measuring techniques of hydrostatic forces on objects.
- To enable the students measure quantities of fluid flowing in pipes, tanks and channels
- To introduce concepts of uniform and non-uniform flows through open channel.
- To impart knowledge on design of turbines and pumps.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe basic terms used in fluid mechanics **(K1)**

CO2: Determine the principles of fluid statics, kinematics and dynamics **(K3)**

CO3: Determine the flow characteristics and classify the flows and estimate various losses in flow through channels **(K3)**

CO4: Analyze characteristics for uniform and non-uniform flows in open channels. **(K4)**

CO5: Distinguish different types of turbines, centrifugal and multistage pumps. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (10 Hrs)

Introduction to Fluid Statics: Distinction between a fluid and a solid - characteristics of fluids - Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the concepts of fluid statics, different equipment and applications (L2)
- Demonstrate stability of floating bodies(L4)

UNIT – II (9 Hrs)

Classification of Fluid Flow - Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three - dimensional continuity equations in Cartesian coordinates.

Fluid Dynamics: Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : Venturimeter, orifice meter and Pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number.

Learning Outcomes: At the end of this unit, students should be able to

- Derive of Continuity equations of using Cartesian coordinates(L3)
- Compare the different types of fluid flows and explain the fundamentals of fluid kinematics. (L2)
- Apply principles of fluid dynamics along with governing equations. (L3)

UNIT – III (8 Hrs)

Energy Losses in Pipelines: Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line, Pipes in Parallel and Series. Laminar Flow- Laminar flow through: circular pipes, and parallel plates. Stoke's law, Measurement of viscosity. Reynolds experiment, Transition from laminar to turbulent flow. -Moody's diagram – Introduction to boundary layer theory.

Learning Outcomes: At the end of this unit, students should be able to

- Estimate Energy losses in pipelines (L5)
- Determine flow characteristics through Pipes.(L3)
- Solve problems for forces in static and moving fluids(L3)

UNIT – IV (9 Hrs)

Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Computation of Uniform flow. Specific energy, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Measurement of Discharge and Velocity .Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow. Hydraulic Jump and classification

Learning Outcomes: At the end of this unit, students should be able to

- Apply energy and momentum principles to fluid flow situations. (L3)
- Differentiate open and closed channel flows (L4)

- Design open-channel flow systems. (L6)

UNIT – V (9 Hrs)

Impact of Jets- Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes - velocity triangles at inlet and outlet - Work done and efficiency - Hydraulic Turbines: Classification of turbines; pelton wheel and its design. Francis turbine and its design - efficiency - Draft tube: theory - Working principles of a centrifugal pump, work done by impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; limitation of suction lift, net positive suction head (NPSH); Performance and characteristic curves; Cavitation effects; Multistage centrifugal pumps; troubles and remedies – Introduction to Reciprocating Pump.

Learning Outcomes: At the end of this unit, students should be able to

- Calculate efficiency of jets (L3)
- Design of Pelton wheel, Francis and Kaplan turbine (L6)
- Design centrifugal pumps including multistage pumps and calculate losses and efficiencies of centrifugal pumps (L6)

TEXTBOOKS:

1. “Hydraulics and Fluid Mechanics”, P. M. Modi and S. M. Seth, Standard Book House
2. “Theory and Applications of Fluid Mechanics”, K. Subrahmanya, Tata McGraw Hill

REFERENCE BOOKS:

1. “Fluid Mechanics and Hydraulic Machines”, R. K. Bansal, Laxmi Publications (P) Ltd., New Delhi.
2. “Open channel Flow”, K. Subramanya, Tata McGraw Hill.
3. “Principles of Fluid Mechanics and Fluid Machines”, N. Narayana Pillai, Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.
4. “Fluid Mechanics and Machinery”, C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.
5. “Hydraulic Machines”, Banga & Sharma, Khanna Publishers

ONLINE LEARNING RESOURCES:

1. https://www.coursera.org/courses?query=fluid%20mechanics
2. https://www.udemy.com/topic/fluid-mechanics/
3. https://onlinecourses.nptel.ac.in/noc21_ce31/preview
4. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iiiiv-fall-2005- spring- 2006/fluid-mechanics/
5. http://lms.msitonline.org/mod/folder/view.php?id=138

Course Code	SURVEYING		L	T	P	C
21A010402			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To make the student to get well conversant with the fundamentals of various basic methods and instruments of surveying.
- To introduce to the students in identifying reduced level of the ground and its profile for finding areas and volumes of embankments and cuttings.
- To make the student to use angular measuring instruments for horizontal and vertical control.
- To enable the student to set simple horizontal curves.
- To introduce the knowledge construction surveys and usage of modern instrument such as total station.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the working principles of survey instruments and measure of angles and distances **(K3)**
CO2: Calculate levels, draw contour maps and compute the areas and volumes of earth work **(K2)**
CO3: Explain the working principle of Theodolite, measure horizontal, vertical angles and calculate heights and distances **(K3)**
CO4: Illustrate the working principles of tachometry and curve setting **(K2)**
CO5: Illustrate the modern survey instruments. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying. Measurement of Distances and Directions Linear distances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections, indirect methods- optical methods- E.D.M. method.

Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination, and dip.

Plane Table Surveying: Introduction, accessories, setting up of plane table, techniques, advantages and disadvantages.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the basic concepts of surveying (L3)
- Estimate the usage and applications of linear and angular measurements through chain, tape, compass and plane table. (L4)
- Apply the knowledge of linear and angular measurements to calculate heights and distances (L3)

UNIT – II (9 Hrs)

Levelling - Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method-Rise and Fall method, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and uses of Contours, Direct & Indirect methods of contour surveying, interpolation and sketching of Contours.

Computation of Areas and Volumes: Areas - Determination of areas consisting of irregular boundary and regular boundary, Planimeter. Volumes - Computation of volumes for level section and two level sections with and without transverse slopes.

Learning Outcomes: At the end of this unit, students should be able to

- Impart basic principles in levelling and contouring. (L3)
- Understand the characteristics and uses of contours. (L2)

UNIT – III (9 Hrs)

Theodolite Surveying: Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method measurement of vertical

Angle, Trigonometrical levelling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic principles of Trigonometric levelling. (L3)
- Express the knowledge of traversing. (L6)
- Compute angles and distances using Theodolite (L3)

UNIT – IV (9 Hrs)

Tacheometric Surveying: Principles of Tacheometry, stadia and tangential methods of Tacheometry. Curves: Types of curves and their necessity, elements of simple circular curve, setting out of simple horizontal circular curves.

Learning Outcomes: At the end of this unit, students should be able to

- Compute the basic principles in Tacheometric surveying (L3)
- Explain the knowledge of simple horizontal circular curve setting (L4)
- Explain the necessity and setting out of simple horizontal circular curves. (L4)

UNIT – V (9 Hrs)

Construction Surveys: Introduction-staking out buildings-pipelines and sewers- highways-culverts.

Total Station Surveying: Basic principles, applications, comparison with conventional surveying. Electromagnetic wave theory - electromagnetic distance measuring system - principle of working and EDM instruments.

Learning Outcomes: At the end of this unit, students should be able to

- Develop the knowledge of construction surveying. (L6)
- Develop the knowledge of advanced surveying instrument such as total station. (L6)

TEXTBOOKS:

1. "Surveying theory and Practice", S.S Bhavikatti, Dreamtech press, Wiley distributors, 2nd Edition.
2. "Text book of surveying", C. Venkatramaiah, Universities press, 2nd Edition, 2018

REFERENCE BOOKS:

1. "Elements of Plane Surveying", Arthur R Benton and Philip J Taety, McGraw Hill, 2000.
2. "Surveying Vol 1, 2 & 3", Arora K R, Standard Book House, Delhi, 2004.
3. "Surveying Vol 1 & 2", S K Duggal, Tata McGraw Hill Publishing Co. Ltd. New Delhi, Jul 2017.
4. "Surveying and leveling", R. Subramanian, Oxford university press, New Delhi.
5. "Surveying and Levelling Vol. 1 and 2", S.S Bhavikatti Dreamtech press, Wiley distributors.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105107122
2. https://nptel.ac.in/courses/105104101

Course Code	STRENGTH OF MATERIALS LAB		L	T	P	C
21A010305			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To find the properties of different materials by practical experimentation
- To know the structural behavior of various material

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the stress-strain behavior of different materials. **(K3)**
CO2: Differentiate between compression and tension testing. **(K2)**
CO3: Evaluate the hardness of different materials. **(K4)**
CO4: Correlate the elastic constants of the materials. **(K4)**
CO5: Explain the relation between elastic constants and hardness of materials. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO2	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	2	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	2	-

LIST OF EXPERIMENTS:

1. Study the stress – strain behavior of (a) Mild Steel (b) Tor Steel by conducting tension test on U.T.M.
2. Conducting the Bending test on (Steel/Wood) Cantilever beam.
3. Conducting the Bending test on (Steel/Wood) simply supported beam.
4. Find the compressive strength of wood and concrete by conducting compression tests.
5. Find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminum(d) Copper by conducting hardness tests
6. Determine the Modulus of rigidity (a) Solid shaft (b) Hollow shaft made of steel
7. Find the spring constant and modulus of rigidity of the material of the a spring by conducting compression test on open coiled helical spring.
8. Determine the Young's modulus of the material by conducting deflection test on a simply supported, cantilever and continuous beams.
9. Find impact strength of a given material by conducting a) Charpy test and b) Izod test
10. Verification of Maxwell's Reciprocal theorem on beams.

11. Find the strength of metal in
    i) Single shear
    ii) Double shear

REFERENCE BOOKS:

1. "Strength of materials lab manual", A. Anand Jaykumar, Noshan press, 2020

Course Code	FLUID MECHANICS AND HYDRAULIC MACHINES LAB		L	T	P	C
21A010403			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To understand the fluid flow concepts and get familiarity with flow measuring devices.
- To provide practical knowledge in verification of principles of fluid flow.
- To impart knowledge in measuring pressure, discharge and velocity of fluid flow.
- To gain knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze a variety of practical fluid-flow devices like venture meter & orifice meter. **(K4)**

CO2: Analyze the performance of different types of turbines like impulse and reaction. **(K4)**

CO3: Analyze the performance of different types of pumps like rotodynamic and positive displacement pumps. **(K4)**

CO4: Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design. **(K4)**

CO5: Analyze the different types of loses in fluid flow problems. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO2	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO5	-	-	-	3	-	-	-	-	3	3	-	-	2	-

LIST OF EXPERIMENTS:

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Calibration of contracted Rectangular Notch
4. Calibration of contracted Triangular Notch.
5. Verification of Bernoulli's equation.
6. Determination of head loss due to friction and friction factor
7. Determine the Coefficient of discharge for a small orifice by constant head method.
8. Determine the Coefficient of discharge for a small orifice by Variable head method.
9. Efficiency test on centrifugal pump.

10. Performance test on Reciprocating pump.
11. Impact of jet of vane.
12. Performance test on pelton wheel turbine with constant head
13. Performance test on pelton wheel turbine with constant speed
14. Determine the Coefficient of discharge for an External Mouth piece by constant head method.

REFERENCE BOOKS:

1. "Fluid Mechanics & Hydraulic Machines - A Lab Manual", Desmukh (Author), Laxmi Publications (P) Ltd
2. "Fluid Mechanics & Machinery Laboratory Manual", N Kumara Swamy (Author), Charotar Books Distributors
3. "Lab. Manual of Fluid Mechanics & Machines", Gupta, Chandra (Author), cbspd (Publisher)

ONLINE LEARNING RESOURCES:

1. http://eerc03-iiith.vlabs.ac.in/

Course Code	SURVEYING FIELD WORK		L	T	P	C
21A010404			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To know the usage of conventional surveying equipment's like chain, tape, compass, dumpy level, theodolite and their practical applicability
- To know the usage of Modern surveying equipment like total station and their practical applicability.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the principles of surveying. **(K5)**

CO2: Compute to find linear and angular measurements, elevations, heights and distances using different surveying equipment. **(K3)**

CO3: Prepare to set curves on plane and hilly areas. **(K6)**

CO4: Draw the contour maps for given location and estimate the volume of earthwork. **(K3)**

CO5: Describe the usage of Modern surveying equipment like total station and their practical applicability. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3	-	-	-	-	3	1	-	1	3	3
CO2	2	2	2	3	2	-	-	-	3	1	-	1	3	3
CO3	2	2	2	2	2	-	-	-	3	-	-	1	3	3
CO4	2	2	2	2	2	-	-	-	3	-	-	1	3	3
CO5	2	2	1	2	1	-	-	-	3	-	-	1	3	3

LIST OF EXPERIMENTS:

1. Survey of an area by chain & Compass (closed traverse)
2. Determination of distance between two inaccessible points with compass.
3. Plane table survey; finding the area of a given boundary
4. Two Point& three Point Problem by the plane table survey.
5. Levelling: Height of the instrument method and rise and fall method.
6. Fly levelling; Longitudinal Section and Cross sections of a given road profile.
7. Theodolite Survey: Determining the Horizontal Angles
8. Theodolite Survey: Determining the Vertical Angles
9. Finding the distance between two inaccessible points using Theodolite
10. Tachometric survey: Heights and distance problems using tachometric principles.
11. Setting of simple curve by Offsets from long chord and from tangents

12. Developing contour map

REFERENCE BOOKS:

1. "Engineering Surveying Laboratory Manual", Robert Hamilton, George Murgel of Kendall, Hunt Publishing Co

Course Code	BUILDING DRAWING		L	T	P	C
21A010701			1	0	2	2
Pre-requisite	Engineering Drawing	Semester	III			

COURSE OBJECTIVES:

- To give training exercises on various signs and bonds and different building units
- To impart the skills and methods of planning of various buildings.
- To impart the planning aspects of residential buildings and public buildings.
- To initiate the student to different building bye-laws and regulations
- To prepare line plans of residential and public buildings using principles of planning.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply knowledge in detailing and drawing of various components of building and types of Buildings. **(K4)**

CO2: Interpret the symbols, signs and conventions from the given drawing. **(K2)**

CO3: Distinguish the plan, elevation, cross-section and identify the form and functions among the buildings. **(K4)**

CO4: Sketch the skills of drawing building elements and plan various types of buildings as per requirements. **(K3)**

CO5: Plan various buildings as per the building by-laws. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	1
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	1
CO3	2	-	-	-	-	-	-	-	-	-	-	-	2	1
CO4	2	-	-	-	-	-	-	-	-	-	-	-	2	1
CO5	2	-	-	-	-	-	-	-	-	-	-	-	2	1

LIST OF EXPERIMENTS:

1. Detailing & Drawing of Sign Conventions.
2. Detailing & Drawing of English Bond.
3. Detailing & Drawing of Flemish Bond.
4. Detailing & Drawing of Doors.
5. Detailing & Drawing of Windows.
6. Detailing & Drawing of Ventilators & Roofs.
7. Drawing of Line Diagram of Residential Buildings by using Building Bye- Laws.
8. Drawing of Plan, Elevation & Section from line diagram for a single Storey Building.

9. Drawing of Plan, Elevation & Section for Hospital Building.
10. Drawing of Plan, Elevation & Section for Industrial Building.

TEXTBOOKS:

1. "Planning and Designing and Scheduling", Gurucharan Singh and Jagadish Singh, Standard publishers, 2020 Edition
2. "Building Planning and Design", N. Kumara Swamy and A. Kameswara Rao, Charotar publications, 9th Edition, 2019

REFERENCE BOOKS:

1. National Building Code 2016
2. "Building construction & drawing", mitchell's building construction and drawing
3. "Building drawing with an integrated approach to building environment", M. G. Saha, G. M. Kale, S. Y. Patki, Tata Mc Graw Hill

ONLINE LEARNING RESOURCES:

1. https://www.studocu.com/row/document/jamaa%D8%A9-byrzyt/buildin construction/lecture- notes

Course Code	CONSTITUTION OF INDIA		L	T	P	C
21A000002	(Common to all branches)		2	0	0	0
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand historical background of the constitution making and its importance for building a democratic India. **(K2)**

CO2: Understand the functioning of three wings of the government i.e., executive, legislative and judiciary. **(K2)**

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India. **(K2)**

CO4: Analyze the decentralization of power between central, state and local self-government **(K4)**

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO2	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO3	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO4	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO5	-	-	-	-	-	3	-	2	1	-	-	1	-	-

UNIT – I (9 Hrs)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution- Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Indian constitution (L1)
- Apply the knowledge on directive principle of state policy (L3)
- Analyze the History and features of Indian constitution (L4)
- Learn about Preamble, Fundamental Rights and Duties (L1)

UNIT – II (9 Hrs)

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of Indian government (L1)
- Differentiate between the state and central government (L4)
- Explain the role of President and Prime Minister (L2)
- Know the Structure of supreme court and High court (L1)

UNIT – III (9 Hrs)

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of state government (L1)
- Analyze the role of Governor and Chief Minister (L4)
- Explain the role of State Secretariat (L2)
- Differentiate between structure and functions of state secretariat (L4)

UNIT – IV (9 Hrs)

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning Outcomes: At the end of this unit, students should be able to

- Understand the local Administration (L1)
- Compare and contrast district administration's role and importance (L4)
- Analyze the role of Mayor and elected representatives of Municipalities (L4)
- Learn about the role of Zilla Parishath block level organization (L1)

UNIT – V (9 Hrs)

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Learning Outcomes: At the end of this unit, students should be able to

- Know the role of Election Commission (L1)

- Contrast and compare the role of Chief Election commissioner and Commissionerate (L4)
- Analyze the role of state election commission (L4)
- Evaluate various commissions viz SC/ST/OBC and women (L6)

TEXTBOOKS:

1. "Introduction to the Constitution of India", Durga Das Basu, Prentice Hall of India Pvt. Ltd. New Delhi
2. "Indian Constitution", Subash Kashyap, National Book Trust

REFERENCE BOOKS:

1. "Dynamics of Indian Government & Politics", J.A. Siwach,
2. "Constitutional Law of India", H.M.Sreevai, 4th edition in 3 volumes (Universal Law Publication)
3. "Indian Government and Politics", J.C. Johari, Hans India

Course Code	PROBABILITY AND STATISTICS		L	T	P	C
21A110110			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To familiarize the students with the foundations of probability and statistical methods.
- To impart probability concepts and statistical methods in various applications Engineering.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve the central tendency, correlation and correlation coefficient and regression **(K6)**

CO2: Understand the terminologies of basic probability, two types of random variables and their probability functions. **(K2)**

CO3: Interpret the behavior of various discrete and continuous probability distributions. **(K3)**

CO4: Apply the concept of hypothesis testing for large samples. **(K3)**

CO5: Apply the statistics for testing the significance of the given small sample data by using t- test, F- test and Chi-square test. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	3	-	-	-	-	-	1	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Statistics Introduction: Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, regression lines, regression coefficients and their properties

***Learning Outcomes*:** At the end of this unit, students should be able to

- Summarize the basic concepts of data science and its importance in engineering (L2)
- Analyze the data quantitatively or categorically, measure of averages, variability (L4)
- Adopt correlation methods and regression analysis (L5)

UNIT – II (9 Hrs)

Probability: probability axioms, addition law and multiplicative law of probability, conditional probability, Bayes theorem, random variables (discrete and continuous), probability density functions, properties.

Learning Outcomes: At the end of this unit, students should be able to

- Define the terms trial, events, sample space, probability, and laws of probability (L1)
- Make use of probabilities of events in finite sample spaces from experiments (L3)
- Apply Bayes theorem to real time problems (L3)
- Explain the notion of random variable, distribution functions and expected value (L2)

UNIT – III (9 Hrs)

Probability Distributions: Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (L3)
- Interpret the properties of normal distribution and its applications (L2)

UNIT – IV (9 Hrs)

Estimation and Testing of Hypothesis, Large Sample Tests: Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of estimation, interval estimation and confidence intervals (L2)
- Apply the concept of hypothesis testing for large samples (L3)

UNIT – V (9 Hrs)

Small Sample Tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the concept of testing hypothesis for small samples to draw the inferences (L3)
- Estimate the goodness of fit (L5)

TEXTBOOKS:

1. "Miller and Freund's Probability and Statistics for Engineers", Richard A. Johnson, Pearson, 7^{th} Edition, 2008.

2. "Fundamentals of Mathematical Statistics", S.C. Gupta and V.K. Kapoor, S. Chand & Sons Publications, 9th Edition, 2009.

REFERENCE BOOKS:

3. "A First Course in Probability", S. Ross, Pearson Education India, 2002.
4. "An Introduction to Probability Theory and its Applications", W. Feller, Wiley Publications, 1st Edition, 1968.
5. "Probability, Random Variables & Random Signal Principles", Peyton Z. Peebles, McGraw Hill Education, 4th Edition, 2001.

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/990692
2. http://nptel.ac.in/courses/9905090/

Course Code	CONCRETE TECHNOLOGY		L	T	P	C
21A010405			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To explain the functional role of ingredients of concrete and apply this knowledge to mix design philosophy.
- To develop fundamental knowledge in the fresh and hardened properties of concrete.
- To inculcate the testing methodology to evaluate the properties of concrete during fresh and hardened stage.
- To impart the knowledge on the behavior of concrete with response to stresses developed.
- To impart the knowledge on the special concretes and design a concrete mix which fulfils the required properties for fresh and hardened concrete.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain various ingredients of concrete and their role. **(K2)**
CO2: Describe the fresh and hardened properties of concrete. **(K2)**
CO3: Describe the behavior of concrete with response to stresses developed **(K2)**
CO4: Design concrete mixes using various methods. **(K6)**
CO5: Explain special concretes for accomplishing performance levels. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT – I (9 Hrs)

Ingredients of Concrete: Cement-chemical composition-hydration process-Bogue's compound-Tests on properties of cement- Types of cement - I.S. Specifications. Aggregates- classification of aggregate – properties and tests on aggregates - I.S. Specifications. Water-quality of water - characteristics of water - I.S. Specifications. Admixtures – classification of chemical admixtures – properties and limitations – classification of mineral admixtures – properties and limitations - I.S. Specifications

Learning Outcomes: At the end of this unit, students should be able to

- List different ingredients of concrete (L1)
- Describe various ingredients of concrete and their role. (L2)

- Explain characteristics of water (L4)
- Describe the application admixture and its effect on properties of concrete. (L2)
- Explain conformity to IS Codes (L4)

UNIT – II (9 Hrs)

Properties and Tests on Concrete: Fresh concrete: Manufacturing of concrete - segregation, bleeding -workability-factors influencing workability, measurement of workability for conventional concrete (Slump Cone, Compaction Factor and Vee-Bee test) & SCC (V-Funnel, L-Box, U- Box, Slump Flow and J–Ring). Hardened concrete: - tests on hardened concrete - Destructive Tests (Compression, Split Tensile and Flexural)- Semi Destructive Tests (Core Cutter and Pull out test) and Non Destructive Tests (Rebound Hammer-UPV - Radiological methods).

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate various properties of fresh concrete (L4)
- Determination of fresh concrete properties by conducting the test (L3)
- Determine various properties of hardened concrete(L1)
- Describes various strengths of concrete by destructive and non-destructive testing methods. (L2)

UNIT – III (9 Hrs)

Curing, Elasticity, Shrinkage and Creep of Concrete: Water/Cement Ratio(Abram's Law)-Gel Space Ratio- Curing of concrete -methods of curing- effects of improper curing-self curing- Modulus of Elasticity-Poisson's Ratio-Dynamic Modulus of Elasticity- Shrinkage and various types - Factors Affecting Shrinkage-Moisture Movement- Creep of Concrete-Factors Influencing Creep,

Learning Outcomes: At the end of this unit, students should be able to

- Explain curing methods and its importance(L4)
- Explain phenomenon of shrinkage and creep of concrete. (L4)
- Evaluate factors influencing creep and concrete (L5)

UNIT – IV (9 Hrs)

Concrete Mix Design: Proportioning of Concrete Mixes- Factors in the choice of mix proportions - Quality Control and Statistical Methods, Durability of concrete and IS 456 provisions on Durability-– Proportioning of concrete mixes by various methods- Mix Design : ACI method & IS 10262 method.

Learning Outcomes: At the end of this unit, students should be able to

- Explain proportioning of concrete mixes(L4)
- Design concrete mixes using different methods(L6)

- Design mix of concrete according to availability of ingredients and design needs. (L6)
- Estimate quantities for target strength of concretes methods. (L4)

UNIT – V (9 Hrs)

Special Concretes: Light Weight Concretes –Light Weight Aggregate Concrete- Cellular Concrete - No Fines Concrete- High Density Concrete – Fiber Reinforced Concrete-Polymer Concrete-Self Compacting Concrete and its Mix Design using EFNARC guidelines- Bacterial concrete (self healing concrete) and High performance concrete

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate different types of special concretes with the objectives(L4)
- Describe the properties of special concretes. (L2)
- Explain special concretes for accomplishing performance levels. (L2)

TEXTBOOKS:

1. “Properties of Concrete”, A. M. Neville, Pearson Publication, 4th Edition
2. “Concrete Technology Theory and Practice”, M.S. Shetty, A. K. Jain, S. Chand and Company Limited, New Delhi

REFERENCE BOOKS:

1. “Concrete Technology”, M. L. Gambhir, Tata Mc. Graw Hill Publishers, New Delhi
2. “Concrete Technology”, A.R. Santha Kumar, Oxford Univ. Press, 2nd Edition, 2018
3. “Concrete: Micro Structure, Properties and Materials”, P. K. Mehta and J. M. Monteiro, Mc- Graw Hill Publishers
4. “Non-Destructive Test and Evaluation of Materials”, J. Prasad, C.G.K. Nair, Tata Mcgraw Hill Publishers, New Delhi

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105102012

CourseCode	ADVANCED STRENGTH OF MATERIALS		L	T	P	C
21A010406			3	0	0	3
Pre-requisite	Strength of Materials	Semester	IV			

COURSE OBJECTIVES:

- To impart basic concepts for determination of Deflection of beam under different end & loading conditions
- To demonstrate analytical methods for determining strength & stiffness of structural members subjected to torsion.
- To determine critical loads for columns with different end conditions.
- To analyze for bending stress in the structural members subjected to eccentric loading
- To demonstrate Hoop, Longitudinal & Radial Stresses in Pressure Vessels.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine deflection at any point on a beam for various loading conditions **(K3)**
CO2: Analyze members under torsion, deformation in springs, **(K4)**
CO3: Analyze the behavior of column for combined bending and axial loading **(K4)**
CO4: Calculate the crippling load for the columns. **(K3)**
CO5: Determine different stresses developed in thin and thick cylinders **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	-	2	2
CO2	2	2	3	2	2	-	-	-	-	-	-	-	2	2
CO3	3	2	3	2	3	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	3	-	-	-	-	-	-	-	2	2
CO5	2	3	3	2	3	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Deflection of Beams: Uniform bending – slope, deflection and radius of curvature – Differential equation for elastic line of a beam – Double integration and Macaulay's methods. Determination of slope and deflection for cantilever and simply supported beams under point loads, U.D.L. uniformly varying load-Mohr's theorems – Moment area method – application to simply supported and overhanging beams- analysis of propped cantilever beams under UDL and point loads.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze types of loads acting on beams (L4)
- Compute slopes and deflections of beams with different boundary conditions(L3)
- Analyze the effect of different loads on propped cantilever beams (L4)

UNIT – II (9 Hrs)

Torsion: Theory of pure torsion – Assumptions and Derivation of Torsion formula for circular shaft– Torsional moment of resistance – Polar section modulus – power transmission through shafts – Combined bending and torsion

Springs: Types of springs – deflection of close coiled helical springs under axial pull and axial couple – Carriage or leaf springs.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze members subjected to torsion, combined torsion and bending moment(L4)
- Calculate power transmission through shafts(L3)
- Estimate energy absorption in springs. (L2)

UNIT – III (9 Hrs)

Columns and Struts: Introduction – classification of columns – Axially loaded compression members – Euler's crippling load theory – derivation of Euler's critical load formulae for various end conditions – Equivalent length – Slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – eccentric loading and Secant formula – Prof. Perry's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Classify columns(L2)
- Analyze Euler's theory on columns and assess crippling loads(L2)
- Analyze compression members using different theories(L4)
- Determine load carrying capacity using different formulae (L3)

UNIT – IV (9 Hrs)

Direct and Bending Stresses: Introduction-eccentric loading – columns with eccentric loading – symmetrical columns with eccentric loading about one axis –about two axes – Unsymmetrical columns with eccentric loading –limit of eccentricity.

Learning Outcomes: At the end of this unit, students should be able to

- Determine the effect of eccentricity effect in columns (L3)
- Describe the about the various theories of failures. (L2)

UNIT – V (9 Hrs)

Thin Cylinders & Thick Cylinders: Thin cylindrical shells –Lames theory, Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – Changes in diameter, and volume of thin cylinders –Design of thin Cylindrical shells, Thin spherical shells. Introduction Lame's theory for thick cylinders – Derivation of lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells.

Learning Outcomes: At the end of this unit, students should be able to

- Determine Hoop & longitudinal stresses in thin cylinders subjected to fluid pressure (L3)
- Apply the Lames theory to thick cylinders (L3)
- Evaluate the radial and hoop stresses acting across the thickness of cylinders(L5)

TEXTBOOKS:

1. “Strength of Materials”, Bansal R. K, Laxmi Publications, 6th Edition, 2018
2. “Strength of Materials”, B. C. Punmia, Laxmi publications, 10th Edition, 2018
3. “Strength of Materials”, S.S. Bhavikatti, Vikas Publishing House Pvt. Ltd., 4th Edition.

REFERENCE BOOKS:

1. “Schaum’s outline series Strength of Materials”, Mc Graw hill International Editions.
2. “Strength of Materials”, L.S. Srinath, Macmillan India Ltd., New Delhi
3. “Strength of Materials”, Gere J.M. and Goodno B.J., Cengage Learning India Private Ltd., Indian Edition (4th reprint), 2009.
4. “Strength of Materials (Mechanics of Solids)”, R. S. Khurmi and N. Khurmi, S Chand and Company Limited, Ramnagar, New Delhi
5. “Strength of Materials”, B. S. Basavarajaiah and P. Mahadevappa, Universities Press Pvt Ltd. Hyderabad, 3rd Edition, 2009.

ONLINE LEARNING RESOURCES:

1. https://archive.nptel.ac.in/courses/92/101/92101095/
2. https://nptel.ac.in/courses/105102012

CourseCode	ENGINEERING GEOLOGY		L	T	P	C
21A010407			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To understand weathering and formation of natural minerals
- To distinguish geological formations
- To identify geological structures and process of rock mass quality.
- To identify subsurface information and groundwater potential sites through geophysical investigations
- To apply geological principles of mitigation of natural hazards and select sites for dams and tunnels

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain basic knowledge on characteristics of rocks **(K4)**
CO2: Explain basic knowledge on characteristics of minerals **(K4)**
CO3: Differentiate and Identify rocks using geological classification **(K4)**
CO4: Select geo physical investigations for infrastructural projects. **(K2)**
CO5: Apply concepts of structural geology for civil engineering structures. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	3	-	3	-	3	2
CO2	2	2	-	-	-	-	-	-	3	-	3	-	3	2
CO3	2	2	-	-	-	-	-	-	3	-	3	-	3	2
CO4	2	2	-	-	-	-	-	-	3	-	3	-	3	2
CO5	2	2	-	-	-	-	-	-	3	-	3	-	3	2

UNIT – I (9 Hrs)

Introduction: Importance of geology from Civil Engineering point of view – branches of geology – structure of earth and its composition Importance of geology from Civil Engineering point of view –weathering of rocks – Types of weathering– Effect over the properties of rocks –importance of weathering – landforms- Groundwater Exploration – Plate tectonics – Earth quakes – Tsunami relevance to civil engineering - Seismic zones in India.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the formation of earth and its internal structure (L4)
- Select the suitable site for important structures (L2)
- Estimate the seismic scales and effects of major earthquakes earth quakes, landslides(L4)

UNIT – II (9 Hrs)

Minerology: Physical properties of minerals – Quartz group, Feldspar group, Pyroxene – hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals - Ore minerals - Study of physical properties of following common rock forming minerals: Feldspar , Quartiz , Flint , Jasper, Olivine , Augite , Hornblende , Muscovite , Biotite , Asbestos, Chlorite , Kyanite , Garnet, Talc , Calcite. Study of other common economics minerals such as Pyrite, Hematite, Magnetite, Chrorite , Galena , Pyrolusite , Graphite, Magnesite, and Bauxite.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the mechanism of weathering and formation of natural minerals(L4)
- Explain composition of minerals and their utilization in construction industry. (L4)
- Identify mineral composition of rock(L2)

UNIT – III (9 Hrs)

Petrology: Definition of rock: Geological classification of rocks into igneous, Sedimentary and metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the classification of rocks (L4)
- Explain the mineral composition of rock (L4)
- Estimate the Engineering properties of rocks (L4)

UNIT – IV (9 Hrs)

Structural Geology and Geophysical Methods - Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults un conformities, and joints – their important types. Their importance Insitu and drift soils, common types of soils, their origin and occurrence in India.

Geophysical Methods – Gravity methods. Magnetic methods, Electrical methods. Seismic methods, Radio metric methods and Geothermal method. Electrical resistivity methods, and seismic refraction methods.

Learning Outcomes: At the end of this unit, students should be able to

- Explain formation of folds strike and dip of geological structures(L4)
- Assess importance of soils(L5)
- Determine the different types of rocks and soils and their origin India(L3)
- Describe the importance of Geophysical investigation(L2)

UNIT – V (9 Hrs)

Application of Geological Investigations: Remote sensing for civil engineering applications; site selection for dams and tunnels –Geological conditions necessary for design and construction of Dams-Geological factors influencing water tightness and life of reservoirs, Factor's Contributing to the success of a reservoir. Investigation of tunnelling- Landslides -over break and lining in tunnels. – Coastal protection structures., causes and mitigation.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the applications in remote sensing(L4)
- Distinguish subsurface information and groundwater(L5)
- Evaluate geological principles of mitigation of natural hazards and select sites for dams and tunnels (L5)

TEXTBOOKS:

1. "Engineering Geology", N. Chennkesavulu, Mc-Millan, India Ltd. 2005
2. "Engineering geology", Vasudev kanthi, Universities press, Hyderabad.
3. "Engineering Geology", D. Venkata Reddy, Vikas Publications, 7th Edition, New Delhi.

REFERENCE BOOKS:

1. "Engineering and General Geology", Parbin Singh, S K Kataria & Sons, 2013.
2. "Engineering Geology", D. Venkata Reddy, Vikas Publishing house, Pvt, Ltd., 2nd Edition
3. "Engineering Geology, Rock in Engineering Construction", Richard E. Goodman, John Wiley & Sons, Inc. 1993.
4. "Engineering Geology", S. K. Duggal, H. K Pandey, N. Rawal, McGraw Hill Education (India) Pvt. Ltd
5. "Structural Geology", Billings, M. P., Prentice-Hall India, 1974, New Delhi

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/95/95/959596/
2. https://freevideolectures.com/course/87/engineering-geology
3. https://www.edx.org/course/geology-and-engineering-geology
4. https://courses.lumenlearning.com/geo/chapter/reading-the-branches-of-geology/
5. https://www.coursera.org/courses?query=geology

Course Code	STRUCTURAL ANALYSIS – I		L	T	P	C
21A010408			3	0	0	3
Pre-requisite	Advanced Strength of Materials	Semester	IV			

COURSE OBJECTIVES:

- To demonstrate various methods of analysis of structural members such as indeterminate beams, frames, etc. which enables the student to solve for forces and moments in various complex structural systems.
- To analyze indeterminate trusses
- To understand the analysis procedures for analyzing fixed and Continuous beams.
- To undergo analysis procedure using slope deflection method
- To undergo analysis procedure using moment distribution method.
- To undergo analysis procedure using Kanis method.

COURSE OUTCOME:

After completion of the course, the student will be able to

CO1: Apply energy theorems for analysis of indeterminate structures **(K3)**
CO2: Analyze indeterminate structures with and without yielding of supports **(K4)**
CO3: Analyze beams and portal frames using slope deflection methods **(K4)**
CO4: Analyze beams and portal frames using moment distribution methods **(K4)**
CO5: Analyze beams and portal frames using Kanis methods **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	1	-	-	1	-	-	2	2	2
CO2	3	-	-	-	3	1	-	-	1	-	-	2	2	2
CO3	3	-	-	-	3	1	-	-	1	-	-	2	2	2
CO4	3	2	-	-	3	1	-	-	1	-	-	2	2	2
CO5	3	2	1	-	3	1	-	-	1	-	-	2	2	2

UNIT – I **(9 Hrs)**

Basic Analysis of Intermediate Structures: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear force**,** Castigliano's first theorem - Deflections of simple beams and pin jointed trusses - Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies – Solution of trusses up to two degrees of internal and external indeterminacy –Castigliano's second theorem.

Learning Outcomes: At the end of this unit, students should be able to

- Develop expression for strain energy due to axial load Bending moment and shear force (L6)
- Calculate deflections in simple beams and pin joined trusses (L3)

- Analyze simple structural elements using energy principles. (L4)
- Analyze different types of trusses and determine forces in the members(L4)

UNIT – II (9 Hrs)

Fixed Propped Cantilevers & Continuous Beams: Introduction to statically indeterminate beams- theorem of three moments-uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads – Shear force and Bending moment diagrams –effect of sinking of support, effect of rotation of a support.

Learning Outcomes: At the end of this unit, students should be able to

- Categorize fixed and continuous beams and their performance(L4)
- Analyze the beams subjected to a different types of support conditions (L4)
- Analyze the effect of sinking of supports performance(L4)

UNIT – III (9 Hrs)

Slope-Deflection Method: Introduction- derivation of slope deflection equation- application to continuous beams with and without settlement of supports- Analysis of single bay, single storey, portal frame including sidesway.

Learning Outcomes: At the end of this unit, students should be able to

- Develop slope deflection expressions (L6)
- Analyze structures with and without support sinking (L4)
- Analyze 2D frames using slope-deflection method. (L4)

UNIT – IV (9 Hrs)

Moment Distribution Method: Introduction to moment distribution method- application to continuous beams with and without settlement of supports. Analysis of single storey ,portal frames – including Sway.

Learning Outcomes: At the end of this unit, students should be able to

- Develop moment distribution expressions(L6)
- Analyze structures with and without support sinking(L4)
- Analyze single storey portal frames(L4)

UNIT – V (9 Hrs)

Kanis Method: Analysis of continuous beams – including settlement of supports and single bay, single storey portal frames with side sway by Kani’s method.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze of continuous beams – including settlement of supports by Kani’s method (L4)
- Analyze single bay, single storey portal frames by Kani’s method (L4)

- Analyze single bay, single storey portal frames with side sway by Kani's method (L4)

TEXTBOOKS:

1. "Basic Structural Analysis", C. S. Reddy, Tata McGraw Hill
2. "Structural Mechanics Vol I & II", Junarkar S. B., Charotar Publishers
3. "Analysis of Structures – Vol I & II", V. N. Vazirani & M. M. Ratwani, Khanna Publications, New Delhi.
4. "Basic Structural Analysis", K.U. Muthu, International Publishing House Pvt. Ltd., 3rd Edition, 2017

REFERENCE BOOKS:

1. "Theory of Structures", Timoshenko & Young, Tata McGraw Hill
2. "Structural analysisVolume 1 and 2", S. S. Bhavikatti, Vikas publishing house pvt. Ltd.
3. "Comprehensive structural analysis Vol-II", Dr.Vaidyanathan, Dr.P.Perumal, Laxmi Publications (P) Ltd.
4. "Theory of Structures", S. Ramamurtham, Dhanpat Rai Publishing Company (p) Ltd, 2009
5. "Structural Analysis", D. S. Prakasa rao, University press, Hyderabad.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/95/95/959596/
2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-571-structural-analysis- and-control-spring-2004/syllabus/

Course Code	ENGINEERING GEOLOGY LAB		L	T	P	C
21A010409			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To give the basic knowledge of Geology that is required for construction of various Civil Engineering Structures.
- To enable the students to identify the physical characteristics of various rocks

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Classify various types of minerals and their properties **(K4)**
CO2: Classify various types of rocks and their properties **(K4)**
CO3: Explain with interpretation of geological maps. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	3	-	1	2	-
CO2	-	-	-	-	-	-	-	-	3	3	-	1	2	-
CO3	3	-	-	-	-	-	-	-	3	3	-	1	2	-

LIST OF EXPERIMENTS:

1. Physical properties of minerals: Mega-scopic identification of Rock forming minerals – Quartz group, Feldspar group,
2. Identification of Rock forming minerals Garnite group, Mica group
3. Physical properties of minerals: Mega-scopic identification of Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc…
4. Physical properties of minerals: Mega-scopic identification of Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc…
5. Megascopic description and identification of Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc…
6. Megascopic description and identification of Sedimentary rocks – Sand stone, Ferrugineous sandstone, Lime stone, Shale, Laterite, Conglamorate, etc…
7. Megascopic description and identification of Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite & Biotiteschist, Marble, Khondalite, etc…
8. Interpretation and drawing of sections for geological maps showing tilted beds
9. Interpretation and drawing of sections for geological maps showing faults,
10. Interpretation and drawing of sections for geological maps showing unconformities etc
11. Simple Structural Geology problems.

12. Strength of the rock using laboratory tests.

REFERENCE BOOKS:

1. "Elementary Exercises in Geology", CVRK Prasad, Universities press.
2. "Engineering Geology Lab Manual", Dr. N. Chennakesavulu, Laxmi Publications, 2017

Course Code	CONCRETE TECHNOLOGY LAB		L	T	P	C
21A010410			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To find the various physical characteristics of cement, fine and coarse aggregates
- To find the various properties of fresh and hardened concrete.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Evaluate the properties of the binding materials for their suitability in building construction. **(K5)**

CO2: Determine workability of concrete for different mix proportions **(K3)**

CO3: Evaluate the strength of hardened concrete through destructive and non-destructive tests **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	-	-	-	2	-	-	-	-	-	-	2	-
CO2	-	3	-	-	-	2	-	-	-	-	-	-	2	-
CO3	-	3	-	-	-	2	-	-	-	-	-	-	2	-

LIST OF EXPERIMENTS:

1. Specific gravity of Fine and coarse aggregate
2. Water Absorption of Coarse and fine aggregate.
4. Bulking of Fine aggregate
5. Determination of fineness modulus of Course & Fine aggregates
6. Specific gravity and fineness of cement,
7. Normal consistency, Initial and final setting times of Cement
8. Soundness and Compressive Strength test of Cement
9. Workability tests -Slump, compaction factor and Vee-Bee time tests on concrete.
10. Design of standard grade concrete using IS and ACI methods, casting of cubes, cylinders and prisms
11. Compressive and split tensile strength of concrete.
12. Flexural strength of concrete
13. Non-destructive test on concrete
    i. Rebound Hammer
    ii. Ultrasonic Pulse Velocity

REFERENCE BOOKS:

1. "Concrete Manual", M. L. Gambhir, Dhanpat Rai & co., 4th Edition.
2. "Building construction and materials (Lab Manual)", Gambhir , TMH publishers.

Course Code	COMPUTER AIDED CIVIL ENGINEERING DRAWING		L	T	P	C
21A010411			0	0	3	1.5
Pre-requisite	Building Drawing	Semester	IV			

COURSE OBJECTIVES:

- To introduce fundamentals of computer aided drawing in Civil Engineering.
- To develop drawing of building components
- To produce 2D & 3D drawings
- To communicate designs graphically
- To teach methodologies for understanding and verification of CAD

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop drawing skills for effective demonstration of building details. **(K6)**
CO2: Sketch Different Sign Conventions and symbols used in building planning **(K3)**
CO3: Sketch Building Components like Masonary Bonds, Doors and windows **(K3)**
CO4: Develop building plans using Computer Aided Design and Drafting software **(K6)**
CO5: Develop Industrial Plannings using Computer Aided Design and Drafting software **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	3	-	-	-	3	2	-	-	1	2
CO2	2	-	-	-	3	-	-	-	3	2	-	-	1	2
CO3	2	-	-	-	3	-	-	-	3	2	-	-	1	2
CO4	2	-	-	-	3	-	-	-	3	2	-	-	1	2
CO5	2	-	-	-	3	-	-	-	3	2	-	-	1	2

LIST OF EXPERIMENTS:

1. Introduction to computer aided drafting
2. Sign conventions and symbols
3. Detailing & Drawing of English Bond.
4. Detailing & Drawing of Flemish Bond.
5. Doors and windows
6. Detailing & Drawing of Ventilators & Roofs.
7. Drawing of Line diagram of Residential Building Using CAD software.
8. Drawing of Plan, Section & Elevation for Residential Buildings Using CAD Software.
9. Drawing Line diagram for Multi Storey Residential Buildings.
10. Drawing of Plan, Section & Elevation for Residential Multi Storey Buildings Using CAD Software.
11. Drawing of Plan, Section & Elevation for Hospital Building Using CAD Software.
12. Drawing of Plan, Section & Elevation for Industrial Buildings Using CAD Software.

TEXTBOOKS:

1. "Building Drawing and Detailing", Balagopal and Prabhu, Spades publishing KDR building, Calicut,(Corresponding set of)CAD Software Theory and User Manuals, 1987.
2. "Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Ajeet Singh Tata-McGraw-Hill Company Limited, New Delhi, 2002

REFERENCE BOOKS:

1. "A Course in Civil Engineering Drawing", V.B. Sikka, S. K. Kataria & Sons, 2013
2. "AUTOCAD for Engineers and Designers", Sham Tickoo, Swapna D Pearson Education, 2009
3. "Engineering Drawing and Graphics + AUTOCAD", Venugopal New Age International Pvt. Ltd., 2007

Note: Software: AUTOCAD 2021 Version 24.0

Course Code	PYTHON PROGRAMMING (Common to CE, EEE, ME & ECE)		L	T	P	C
21A050701			1	0	2	2
Pre-requisite	C Programming & Data Structures	Semester	IV			

COURSE OBJECTIVES:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- To understand the object-oriented concepts using Python in problem solving.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Student should be able to understand the basic concepts of Python Programming language such as conditional processing, Loops, and other data structures. **(K2)**

CO2: Develop the python programme especially with the built-in objects of Python. **(K6)**

CO3: Create practical and contemporary applications such as Machine Learning algorithms. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	3	2
CO2	2	2	2	1	3	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	3	-	-	-	-	-	-	-	3	2

Topics to be covered:

Introduction: What is a program, running python, Arithmetic operators, Value and Types.

Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.

Functions: Function Definitions and Uses, Math functions,

Conditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Recursion, Keyboard input.

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, it’s Looping

Tuples: Tuples are immutable, Tuple Assignment

Files: Persistence, Reading and writing, Format operator, Filename and paths,
Classes and Objects: Programmer-defined types, Classes, Objects, methods and modules.

The turtle module & tkinter module: graphics-based Object shapes drawing fundamentals, GUI design Fundamentals

LABORATORY EXPERIMENTS:

1. Install Python Interpreter and use it to perform different Mathematical Computations.
2. Write a Python Program to find sum of given n numbers
3. Write a Python Program to generate Fibonacci Numbers up to a given number
4. Write a Python Program to display multiplication Table of a given Number
5. Write a Python Program to read a list of names from keyboard, sort them and write them into a File
6. Write a Python Program to concatenate two files content and write the result into a new File.
7. Write a Python Program to perform the addition of two matrices.
8. Write a Python Program to search a given word in the given text file and display the number of occurrences of the string.
9. Write the step-by-step Solution procedure to find the LCM and GCD (HCF) of 2 given numbers
10. Find mean, median, mode for the given set of numbers in a list
11. Python Code to create module called "mathematics" having functions add (), subtract(), div(), mul() and access them by another Program.
12. Develop Python program for illustrating the object-oriented features supported by Python
13. Write a function that draws a Pyramid with #symbols

```
   #
  # ##
 # # # ##
# # # # # ##
```

up to 15 hashes at the bottom

14. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Use object-oriented approach.
15. Using turtles concept draw Olympic Symbol
16. The time module provides a function, also named time that returns the current Greenwich Mean Time in "the epoch", which is an arbitrary time used as a reference point

a. >>> import time
b. >>>time.time () 14377460
   a. 94.5735958

17. Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.
18. Given a text of characters, write a program which counts number of vowels, consonants and special characters.
19. Write program which performs the following operations on list's. Don't use built-in functions
    a) Updating elements of a list
    b) Concatenation of list's
    c) Check for member in the list
    d) Insert into the list
    e) Sum the elements of the list
    f) Push and pop element of list
    g) Sorting of list
    h) Finding biggest and smallest elements in the list
    i) Finding common elements in the list
20. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.
21. Develop Python Program to create Login Screen and evaluate user Input?

TEXTBOOKS:

1. "Think Python", Allen B. Downey, SPD/O'Reilly, 2nd edition, 2016.

REFERENCE BOOKS:

1. "The Complete Reference: Python", Martin C. Brown, McGraw-Hill, 2018.
2. "Fundamentals of Python", Kenneth A. Lambert, B.L. Juneja, CENGAGE, 2015.
3. "Core Python Programming", R. Nageswara Rao, Dreamtech Press, 2nd edition, 2019

Course Code	DESIGN OF REINFORCED CONCRETE STRUCTURES		L	T	P	C
21A010412			3	0	0	3
Pre-requisite	Advanced strength of materials	Semester	V			

COURSE OBJECTIVES:

- To enable the students to understand the various design philosophies based on working stress and limit state methods.
- To impart design procedure of RC elements in flexure, shear and torsion.
- To teach the students about the design of reinforced concrete beam, column, slab& footing
- To enhance competence in design of reinforced concrete structures.
- To teach design procedure for short and long RC columns.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply with the basic concepts of reinforced concrete design parameters, methods to design different types of beams as per IS -456. **(K3)**

CO2: Classify the behavior and various modes of failure of reinforced concrete members, Design of RC beams subjected to shear and torsion adopting IS Code **(K4)**

CO3: Analyze and design various reinforced concrete columns under different loads adopting IS Code. **(K4)**

CO4: Design and detail various reinforced concrete footings under different loads adopting IS Code **(K6)**

CO5: Design and detail various reinforced concrete slabs and doglegged stair case under different loads adopting IS Code **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	1	-	-	-	2	1	3	3
CO2	3	2	3	-	-	-	1	-	-	-	2	1	3	3
CO3	3	2	3	-	-	-	1	-	-	-	2	1	3	3
CO4	3	2	3	-	-	-	1	-	-	-	2	1	3	3
CO5	3	2	3	-	-	-	1	-	-	-	2	1	3	3

UNIT – I (10 Hrs)

Introduction: Concepts of Reinforced concrete Design – Introduction to Working Stress Method - Limit State method –Material Stress- Strain Curves – Safety factors – Characteristic values. Stress Block parameters – IS – 456:2000.

Beams: Limit state analysis and design of singly reinforced, doubly reinforced rectangular, T and L Beam sections

Learning Outcomes: At the end of this unit, students should be able to

- Familiarize with working stress and limit stress method of design.(L3)
- Determine stress block parameters in methods of analysis. (L3)
- Design of beams of various cross sections adopting IS 456 (L6)

UNIT – II (9 Hrs)

Shear, Torsion and Bond: Limit state analysis and design of section for shear and torsion – Concept of bond, anchorage and development length. Limit state design for serviceability for deflection, cracking and IS code provision. Design examples in simply supported and continuous beams, detailing;

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate importance of bond and anchorage(L4)
- Explain the importance of Limit state design for serviceability for deflection and cracking(L4)
- Design and Detail RC beams under due to shear and torsion adopting IS Code. (L6)

UNIT – III (9 Hrs)

Columns: Short and Long columns – Under axial loads, Uni-axial bending and bi-axial bending – I S Code provisions.

Learning Outcomes: At the end of this unit, students should be able to

- Estimate the behavior of different types of columns (L4)
- Analyze the behavior of columns under uni-axial and bi-axial eccentricities (L4)
- Design and detail of RC columns under different loads adopting IS Code. (L6)

UNIT – IV (9 Hrs)

Footings: Different types of footings – Design of isolated, square, rectangular, circular footings

Learning Outcomes: At the end of this unit, students should be able to

- Classify footings based on shape and utility (L2)
- Anticipate the the field conditions and suggest appropriate footings (L6)
- Design reinforced concrete footings. (L6)

UNIT – V (8 Hrs)

Slabs & Staircase: Design of one-way slab, Two-way slabs and continuous slab using I.S.. Coefficients, Design of doglegged staircase

Learning Outcomes: At the end of this unit, students should be able to

- Design reinforced concrete slabs(L6)
- Design Stair cases as per IS code. (L6)

Codes/Tables: IS 456-2000 and relevant sheets (Pertaining to columns) of SP 16 Code books to be permitted into the examinations Hall.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B.
Part A consist of two questions in Design and Drawing out of which one question is to be answered.
Part B should consist of five questions on design out of which three are to be answered.
Weightage for Part – A is 40% and Part- B is 60%.

TEXTBOOKS:

1. "Limit State Design of Reinforced Concrete", P. C. Varghese, Prentice Hall of India, New Delhi, 2nd Edition, 2010
2. "Structural Design and Drawing: Reinforced Concrete and Steel", N Krishna Raju, Universities Press, 4th Edition, 2022

REFERENCE BOOKS:

1. "Limit State Design of Reinforced Concrete", B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, Publications Pvt. Ltd., New Delhi
2. "Fundamentals of reinforced concrete", N. C. Sinha and S. K Roy, S. Chand publishers
3. "Design of Reinforced concrete structures", N. Subramanian, Oxford university press.
4. IS 456- 2000 Code of practice for Reinforced Concrete Structures.

ONLINE LEARNING RESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105105/

Course Code	GEOTECHNICAL ENGINEERING		L	T	P	C
21A010413			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To enable the student to find out the index properties of the soils and their classification.
- To enable the student to determine permeability of soils using various methods, and to understand the concept of seepage of water through soil
- To impart knowledge on various factors governing the engineering behaviors of soils and suitability of soils for various geotechnical engineering applications.
- To enable the students to understand the difference between compaction and consolidation.
- To impart knowledge on shear strength and its importance

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the soil mechanics theory to Various Geotechnical Design Problems and Determine the Index Properties classify soil based on different limits **(K2)**

CO2: Determine the permeability of soils and stratified soils and explain factors effecting permeability by estimating the rate of seepage using flow nets. **(K3)**

CO3: Analyze the stresses in soil under various loading conditions and understand mechanism of compaction and compaction control techniques. **(K4)**

CO4: Solve practical problems related to consolidation settlement and assessment of final settlement of soil by differentiate primary and secondary settlement **(K3)**

CO5: Analyze the strength tests of soil under different drainage conditions **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	-	-	-	-	-	-	-	2	2	2
CO2	2	3	2	2	-	-	-	-	-	-	-	2	2	2
CO3	2	3	2	2	-	-	-	-	-	-	-	2	2	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2	2	2
CO5	2	3	2	2	-	-	-	-	-	-	-	2	2	2

UNIT – I (9 Hrs)

Introduction: Soil formation – soil structure – clay Minerology-Adsorbed water – Mass- volume relationship – Relative density. Index Properties Of Soils: Moisture Content, Specific Gravity, In-situ density, Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – I.S. Classification of soils.

Learning Outcomes: At the end of this unit, students should be able to

- Determine the characteristics of soils (L3)

- Assess relationships between different parameters (L5)
- Determine the soil properties (L3)
- Determine Liquid, Shrinkage and Plasticity Limits (L3)
- Classify soils based on different limits (L4)

UNIT – II (9 Hrs)

Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law permeability – Factors affecting – laboratory determination of coefficient of permeability – Permeability of layered systems.

Seepage through Soils: Total, neutral and effective stresses –quick sand condition – Seepage through soils – Flow nets: Characteristics and Uses.

Learning Outcomes: At the end of this unit, students should be able to

- Determine the permeability of soils and stratified soils. (L3)
- Explain factors effecting permeability. (L4)
- Estimate the rate of seepage using flow net. (L5)

UNIT – III (9 Hrs)

Stress Distribution in Soils: Boussinesq's and Wester guard's theories for point loads and areas of different shapes – Newmark's influence chart. Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties. – Field compaction Equipment – compaction control

Learning Outcomes: At the end of this unit, students should be able to

- Estimate stresses in soils under various loading conditions. (L4)
- Evaluate the maximum dry density of soil by using compaction technique. (L5)

UNIT – IV (9 Hrs)

Consolidation: Types of compressibility – Immediate Settlement, primary consolidation and secondary consolidation - stress history of clay; e-p and e-log p curves– normally consolidated soil, over consolidated soil and under consolidated soil – pre- consolidation pressure and its determination – Terzaghi's 1-D consolidation theory – coefficient of consolidation: square root time and logarithm of time fitting methods.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate compaction and consolidation(L4)
- Assess final settlements of soil(L5)
- Differentiate primary and secondary consolidation(L4)

UNIT – V (9 Hrs)

Shear Strength of Soils: Importance of shear strength – Mohr's– Coulomb Failure theories– Types of laboratory tests for strength parameters – strength tests based on drainage conditions – strength envelops- critical void ratio – Liquifaction.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate the shear strength of the soil (L4)
- Evaluate the various shear tests based on drainage conditions(L6)

TEXTBOOKS:

1. "Soil Mechanics and Foundation Engineering", K.R. Arora, Standard Publishers and Distributors Delhi, 7th Edition, 2019
2. "Geotechnical Engineering", C. Venkataramiah, New age International Pvt. Ltd, 2018.

REFERENCE BOOKS:

1. "Soil Mechanics and Foundation", B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi publications Pvt. Ltd., New Delhi, 17th Edition, 2017.
2. "Geotechnical Engineering", Iqbal H. Khan, PHI pubilishers. 4th Edition.
3. "Basic and Applied Soil Mechanics", Gopal Ranjan & ASR Rao, New age International Pvt. Ltd, New Delhi, 3rd Edition, 2016.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105101201
2. https://nptel.ac.in/courses/105105185

Course Code	STRUCTURAL ANALYSIS-II		L	T	P	C
21A010414			3	0	0	3
Pre-requisite	Structural Analysis – I	Semester	V			

COURSE OBJECTIVES:

- To develop ability to Analyze and the effect of support settlements for indeterminate structures by Flexibility Matrix method.
- To develop ability to analyze the effect of support settlements for indeterminate structures by Stiffness Matrix method.
- To develop Ability to analyze and perform plastic analysis on various structural elements.
- To enable the student to analyze the two hinged and three hinged arches
- To enable the student to draw the influence lines of variable for a given moving load on bridges.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the final moments at the ends of the members by flexibility matrix method. **(K4)**
CO2: Analyze the final moments at the ends of the members by stiffness matrix method. **(K4)**
CO3: Analyze the formation of plastic hinges in different mechanisms. **(K4)**
CO4: Analyze bending moment, normal thrust and radial shear in the arches. **(K4)**
CO5: Draw the influence line diagram for a given moving load on bridges. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO4	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO5	2	2	2	2	-	-	-	-	-	-	-	2	2	2

UNIT – I (9 Hrs)

Flexibility Matrix Method System Approach: Flexibility methods- Introduction- Application to continuous beams including support settlements-Analysis of Single Bay single storey portal frames without and with side sway, BMD and Elastic Curve.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate matrix methods in structural analysis. (L4)
- Evaluate flexibility matrix for the structural elements. (L4)

UNIT – II (9 Hrs)

Stiffness Matrix Method System Approach: Stiffness methods- Introduction-application to continuous beams including support settlements- Analysis of Single Bay single storey portal frames without and with side sway, BMD and Elastic Curve.

Learning Outcomes: At the end of this unit, students should be able to

- Develop stiffness matrix for the structural elements. (L6)
- Develop relationship between flexibility and stiffness matrices. (L6)

UNIT – III (9 Hrs)

Plastic Analysis: Introduction- definition of plastic hinge and plastic moment capacity – Assumptions- shape factor- shape factor for general sections – collapse load – basic theorems for finding collapse loads-methods of plastic analysis-static method-kinematic method- kinematic method applied to beams and simple frames- beam mechanism- sway mechanism- combined mechanism.

Learning Outcomes: At the end of this unit, students should be able to

- Estimate plastic moment capacity of a structural member. (L4)
- Calculate the collapse load for a structural member. (L4)
- Reduce the collapse mechanism for a structural member. (L4)

UNIT – IV (9 Hrs)

Arches: Three hinged arches, Elastic theory of arches – Eddy's theorem –Determination of horizontal thrust, bending moment, normal thrust and radial shear effect of temperature-**Two Hinged Arches**-Determination of horizontal thrust bending moment, normal thrust and radial shear – Rib shortening and temperature stresses.

Learning Outcomes: At the end of this unit, students should be able to

- Estimate the temperature effect in arches. (L4)
- Differentiate between two hinged and three arches. (L4)
- Analyze the arches by finding axial thrust and radial shear. (L4)

UNIT – V (9 Hrs)

Rolling Loads And Influence Line Diagrams For Determinate Structures: Introduction- simply supported beams – single concentrated load- UDL longer than the beam span – UDL shorter than the beam span- two wheel axles separated by a distance- multiple wheel axles (train of loads)- influence line diagram for shear force and bending moments.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the effect of rolling loads on bridges (L4)
- Develop the influence lines of diagram for a given moving load on bridges(L6)

TEXTBOOKS:

1. "Analysis of structures", Vazrani & Ratwani, Khanna Publications, Standard Edition,1999
2. "Indeterminate Structural Analysis", K. U. Muthu, M. Janardhana, Dreamtech Press, 2021
3. "Basic Structural Analysis", C. S. Reddy, Tata McGraw Hill,Third Edition,2017
4. "Structural analysis Volume 1 and 2", S.S. Bhavikatti, Vikas publishing house pvt. Ltd,, 4th Edition, 2011

REFERENCE BOOKS:

1. "Theory of structures", Ramamuratam, Jain book depot , New Delhi, 9th Edition, 2015
2. "Structural Analysis: A Unified Approach", D S Prakash Rao, Universities Press, 1996
3. "Structural analysis", R. S. Khurmi, S. Chand Publications, New Delhi, 2020 Edition.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105105166,https://nptel.ac.in/courses/105101085

Course Code	WATER RESOURCES ENGINEERING	L	T	P	C
21A010415		3	0	0	3
Pre-requisite	NIL	V			

COURSE OBJECTIVES:

- To introduce the types of irrigation systems and introduce the concepts of planning and design of irrigation systems
- To understand design methods of erodible and non-erodible canals
- To know the principles of design of hydraulic structures on permeable foundations
- To know the concepts for analysis and design principles of storage and diversion works.
- To learn design principles of canal structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the importance of hydrological cycle and estimate runoff **(K2)**
CO2: Illustrate about hydrograph and ground water. **(K3)**
CO3: Administer the water requirement for various types of soil & crops. **(K3)**
CO4: Explain the slit theory using various types of channels and silt theories **(K2)**
CO5: Illustrate various headworks, their failures using different theories. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	2	-	-	-	-	-	2	2
CO2	2	2	2	2	-	-	2	-	-	-	-	-	2	2
CO3	2	2	2	2	-	-	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	-	2	-	-	-	-	-	2	2
CO5	2	2	2	2	-	-	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Introduction to Hydrology: Engineering hydrology and its applications; Hydrologic cycle; precipitation- Types and forms, rainfall measurement, types of rain gauges, computation of average rainfall over a basin, presentation and interpretation of rainfall data.

Descriptive Hydrology: Evaporation- Factors affecting evaporation, measurement of evaporation; Infiltration- Factors affecting infiltration, measurement of infiltration, infiltration indices; Run off- Factors affecting run- off, Computation of run-off; Design Flood; Estimation of maximum rate of run-off; separation of base flow.

Learning Outcomes: At the end of this unit, students should be able to

- Describe about the Hydrological Cycle (L1)
- Analyze the rainfall data (L4)
- Compute runoff (L3)

UNIT – II (9 Hrs)

Hydrograph Analysis: Hydrograph; Unit Hydrograph- Construction and limitations of Unit hydrograph, Application of the unit hydrograph to the construction of a flood hydrograph resulting from rainfall of unit duration; S-hydrograph.

Ground Water: Introduction; Aquifer; Aquiclude; Aquifuge; aquifer parameters- porosity, Specific yield, Specific retention; Divisions of sub–surface water; Water table; Types of aquifers; storage coefficient-coefficient of permeability and transmissibility

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on Ground Water. (L3)
- Determine runoff characteristics and types of aquifers (L3)
- Examine components of hydro graph. (L3)

UNIT – III (9 Hrs)

Irrigation: Introduction; Necessity and Importance of Irrigation; advantages and ill effects of Irrigation; types of Irrigation; methods of application of Irrigation water; quality for Irrigation water. Duty and delta; duty at various places; relation between duty and delta; factors affecting duty; methods of improving duty.

Water Requirement of Crops: Types of soils, Indian agricultural soils, preparation of land for Irrigation; soil fertility; Soil-water-plant relationship; vertical distribution of soil moisture; soil moisture tension; soil moisture stress; various soil moisture constants; Limiting soil moisture conditions; Depth and frequency of irrigation; Gross command area; Culturable command area; Culturable cultivated and uncultivated area; Kor depth and Kor period; crop seasons and crop rotation; Irrigation efficiencies; Determination of irrigation requirements of crops; Assessment of Irrigation water. Consumptive use of water-factors affecting consumptive use, direct measurement and determination by use of equations (theory only)

Learning Outcomes: At the end of this unit, students should be able to

- Explain the Importance of irrigation(L3)
- Determine the Duty and delta(L3)
- Identify the water Requirements for crop(L2)

UNIT – IV (9 Hrs)

Channels – Silt Theories: Classification; Canal alignment; Inundation canals; Cross–section of an irrigation channel; Balancing depth; Borrow pit; Spoil bank; Land width; Silt theories– Kennedy's theory, Kennedy's method of channel design; Drawbacks in Kennedy's theory; Lacey's regime theory-Lacey's theory applied to channel design; Defects in Lacey's theory; Comparison of Kennedy's and Lacey's theory.

Water Logging and Canal Lining: Water logging; Effects of water logging; Causes of water logging; Remedial measures; Saline and alkaline soils and their reclamation; Losses in canal; Lining of irrigation channels – Necessity, advantages and disadvantages; Types of lining; Design of lined canal.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Various Theories for slit. (L4)
- Determine Water logging and effects due to water logging. (L3)

UNIT – V (9 Hrs)

Diversion Head Works: Types of diversion head works; Diversion and Storage head works; weirs and barrages; Layouts of diversion head works; components; Causes and failure of hydraulic structures on permeable foundations; Blighs creep theory; Khoslas theory; Determination of uplift pressure, impervious floors using Blighs and Khoslas theory; Exit gradient.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about diversion head works and various theories. (L4)
- Analyze khoslas theory. (L4)

TEXTBOOKS:

1. "Irrigation and water power engineering", Punmia & Lal, Laxmi publications pvt. Ltd., New Delhi, 17th Edition, 2021
2. "Engineering Hydrology", K. Subramanya, The Tata McGraw Hill Company, 5th Edition, 2020

REFERENCE BOOKS:

1. "Irrigation Engineering and Hydraulic structures", S. K. Garg, Khanna Publishers, Delhi 36th Edition
2. "Engineering Hydrology", Jayarami Reddy, Laxmi publications pvt. Ltd., New Delhi 3rd Edition, 2016
3. "Irrigation and Water Resources & Water Power", P. N. Modi, Standard Book House, 6th Edition, 2020

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105101214

Course Code	GREEN BUILDINGS	L	T	P	C
21A010416		3	0	0	3
Pre-requisite	NIL	V			

COURSE OBJECTIVES:

- To understand the definition, concept and objectives of the terms cost effective construction and green building.
- To apply cost effective techniques in construction
- To apply cost effective technologies and methods in construction
- To understand the problems due to global warming
- To state the concept of Green Building
- To understand Green Buildings

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Select different building materials for construction. **(K3)**
CO2: Apply effective environment friendly building technology. **(K3)**
CO3: Analyze global warming due to different materials in construction. **(K4)**
CO4: Analyze buildings for green rating **(K4)**
CO5: Identify alternate sources of energy and effective use of water. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	1	1	-	-	-	-	-	-	-
CO2	2	1	-	-	-	1	1	-	-	-	-	-	-	-
CO3	2	1	-	-	-	1	1	-	-	-	-	-	-	-
CO4	2	1	-	-	-	1	1	-	-	-	-	-	-	-
CO5	2	1	-	-	-	1	1	-	-	-	-	-	-	-

UNIT – I (10 Hrs)

Introduction to the concept of cost effective construction: Uses of different types of materials and their availability, Stone and Laterite blocks, Burned Bricks, Concrete Blocks, Stabilized Mud Blocks, Lime Pozzolana Cement, Gypsum Board, Light weight beams, Fiber Reinforced Cement Components, Fiber Reinforced Polymer Composite, Bamboo, Availability of different materials, Recycling of building materials, Brick, Concrete, Steel, Plastics, Environmental issues related to quarrying of building materials

Learning Outcomes: At the end of this unit, students should be able to

- Explain the Uses of different types of materials and their availability for cost effective construction (L5)

UNIT – II (9 Hrs)

Environment friendly and cost effective Building Technologies: Different substitute for wall construction Flemish Bond, Rat trap Bond, Arches, Panels, Cavity Wall, Ferro Cement and Ferro Concrete constructions, different pre cast members using these materials, Wall and Roof panels, Beams, Columns, Door and Window frames, Water tanks, Septic tanks, Alternate roofing systems, Filler Slab, Composite Beam and Panel roof, Pre-engineered and ready to use building elements, wood products, steel and plastic, Contributions of agencies, Costford, Nirmithi Kendra, Habitat

Learning Outcomes: At the end of this unit, students should be able to

- Determine the importance of cost effective building technologies (L5)
- Explain the concept of alternate roofing system (L5)

UNIT – III (8 Hrs)

Global Warming: Definition, Causes and Effects, Contribution of Buildings towards Global Warming, Carbon Footprint, Global Efforts to reduce carbon emissions, Green Buildings – Definition, Features, Necessity, Environmental benefit, Economical benefits, Health and Social benefits, Major Energy efficient areas for buildings, Embodied energy in Materials, Green Materials, Comparison of Initial Cost of Green vs Conventional Building, Life cycle cost of Buildings.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of green building to reduce carbon emission (L5)
- Compare the Initial Cost of Green vs Conventional Building (L4)

UNIT – IV (10 Hrs)

Green Building rating Systems: BREEAM, LEED, GREEN STAR, GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings, Purpose, Key highlights, Point System with differential weight age. Green Design – Definition, Principles of Sustainable development in building design, Characteristics of sustainable buildings, Sustainably managed materials, Integrated Lifecycle design of materials and Structures (Concepts only).

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the importance of Integrated Lifecycle design of Materials and Structures (L4)
- Explain the characteristics of sustainable buildings (L5)

UNIT – V (9 Hrs)

Utility of Solar Energy in Buildings: Concepts of Solar Passive Cooling and Heating in Buildings, Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings

Green Composites for Buildings: Concepts of Green Composites, Water Utilization in buildings, Low energy approaches to water management, Management of Solid wastes, Management of

Sullage Water and sewage, Urban environment and Green buildings, Green Cover and Built environment.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the alternate source of energy and effective use of water (L5)
- Elaborate the utility of solar energy in building (L5)

TEXTBOOKS:

1. “Green Building Fundamentals”, Harhara Iyer G, Notion Press
2. “Green Building: Principles & Practices”, Dr. Adv. Harshul Salva

REFERENCE BOOKS:

1. “Complete Guide to Green Buildings”, Trish Riley
2. “Standard for the design for High Performance Green Buildings”, Kent Peterson, 2009

ONLINE LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=THgQF8zHBW8
2. https://www.youtube.com/watch?v=DRO_rIkywxQ

Course Code	ADVANCED SURVEYING		L	T	P	C
21A010417			3	0	0	3
Pre-requisite	Surveying	Semester	V			

COURSE OBJECTIVES:

- To make the student to get well conversant with the fundamentals of triangulation surveying.
- To introduce to the students the methods of hydrographic surveying
- To enable the student to set different types of curves.
- To introduce the knowledge on remote sensing & GPS.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify about geodetic surveying and base line measurement **(K2)**

CO2: Describe about various types of tides and application of sounding equipment **(K2)**

CO3: Explain about Global Positioning System, Photogrammetry. **(K3)**

CO4: Apply the concept of setting of curves to suit the field conditions **(K3)**

CO5: Illustrate the basic concepts of remote sensing, satellites and sensors **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Triangulation: Geodetic surveying- classification of triangulation system- triangulation figures-strength of figure-reconnaissance- signals and towers.

Base Line Measurement- calculation of length of base line-Selecting a base line site- apparatus for baseline measurement-fieldwork for base measurement- corrections to the observed length of a base line-the base net-auxiliary operations in base line work.

Learning Outcomes: At the end of this unit, students should be able to

- Practice basic concepts of triangulation surveying. (L3)
- Calculate the essentials in the base line measurement in a triangulation system. (L3)

UNIT – II (9 Hrs)

Hydrographic Surveying – Introduction-tides-equilibrium theory-spring tides and neap tides-priming and lagging-primary and derivative tide waves – lunar tidal interval- tide prediction-tide gauges-mean sea level-shoreline surveys-sounding equipment and methods-locating the soundings –reduction and plotting the soundings-three point problem-tidal current surveys capacity of a reservoir –river surveying –area velocity method-weir method-chemical method .

Learning Outcomes: At the end of this unit, students should be able to

- Explain basic principles in hydrographic surveying. (L5)
- Assess the practical applications of soundings in hydrographic surveying. (L5)

UNIT – III (9 Hrs)

Photogrammetric Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

Learning Outcomes: At the end of this unit, students should be able to

- Apply photogrammetric surveying adopting various techniques. (L3)
- Develop Map areas using triangulation(L6)
- Classify different types of plotting instruments (L4)

UNIT – IV (9 Hrs)

Typical Curve Setting: Compound and reverse curves- elements of compound curve-relationship between the parts of a compound curve-setting out compound curve-elements of a reverse curve-relationships between various parts of a reverse curve. Transition curves-general requirements-length of transition curve- the ideal transition curve: clothoid- characteristics of a transition curve-computations and setting out – spiraling compound curves – spiraling of reverse curves – Bernoulli's lemniscates curve. Vertical curves: Introduction to vertical curves – Types of vertical curves.

Learning Outcomes: At the end of this unit, students should be able to

- Prioritize about necessity of compound and reverse curves. (L5)
- Prioritize the essentiality condition for transition curves(L5)
- Asses the type of vertical curves to suit the field conditions. (L5)

UNIT – V (9 Hrs)

Remote Sensing: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

GPS: Segments, GPS measurements, errors and biases, co-ordinate transformation, accuracy considerations.

Learning Outcomes: At the end of this unit, students should be able to

- Determine principles of remote sensing (L3)
- Carryout date acquisition and interpretation (L2)
- Apply the principles of GPS(L2)

TEXTBOOKS:

1. "Surveying and leveling", R. Subramanian, Oxford university press, New Delhi.2007
4. "Higher Surveying", Chandra A M, New age International Pvt. Ltd., Publishers, New Delhi, 2002.
5. "Global Positioning System" - Theory and Practice, Hoffman. B, H. Lichtenegga and J. Collins, Springer -Verlag Publishers, 2001.
6. "Text book of surveying", C. Venkatramaiah, Universities press, 2nd Edition, 2018

REFERENCE BOOKS:

1. "Elements of Plane Surveying", Arthur R Benton and Philip J Taety, McGraw Hill, 2000.
2. "Surveying Vol 1, 2 & 3", Arora K R Standard Book House, Delhi, 2004.
3. "Surveying (Vol – 1, 2 & 3)", B. C. Punmia, Ashok K umar Jain and Arun Kumar Jain, Laxmi Publications (P) ltd., New Delhi.
4. "Plane Surveying", Chandra A M, New Age International Pvt. Ltd., New Delhi, 2002.
5. "Surveying", Bhavikatti, Vikas publishing house ltd.
6. "Surveying (Vol – 1 & 2)", Duggal S K, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2004.
7. "Surveying and levelling", R. Agor, Khanna Publishers 2015.

ONLINE LEARNING RESOURCES:

1. https://www.digimat.in/nptel/courses/video/105107121/L01.html
2. https://www.digimat.in/nptel/courses/video/105107121/L02.html
3. https://www.digimat.in/nptel/courses/video/105107158/L17.html
4. https://www.udemy.com/course/surveying/
5. https://onlinecourses.nptel.ac.in/noc20_ce18/preview

Course Code	COMPUTER AIDED DESIGN LAB		L	T	P	C
21A010418			0	0	3	1.5
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand the details of STAAD Pro software package.
- To design different components of structures
- To learn the details of STAAD Pro software package and know the behavior of RCC and Steel structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Asses the details of STAAD Pro software package **(K2)**
CO2: Prepare input data of STAAD Pro. **(K6)**
CO3: Run STAAD Pro for analysis and design of structures. **(K4)**
CO4: Design different components of structures **(K6)**
CO5: Expertise in functionalities like model generation and editing; loading analysis; concrete designing etc. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	3	-	3	-	-	-	-	-	-	3	3	3
CO2	1	3	3	-	3	-	-	-	-	-	-	3	3	3
CO3	1	3	3	-	3	-	-	-	-	-	-	3	3	3
CO4	1	3	3	-	3	-	-	-	-	-	-	3	3	3
CO5	1	3	3	-	3	-	-	-	-	-	-	3	3	3

LIST OF EXPERIMENTS:

1. Introduction to STAAD Pro
2. Beam Analysis & Design
3. Rectangular & Circular Columns Analysis & Design
4. 2D Frame Analysis & Design
6. 3D Frame Analysis & Design
7. 2D Truss Analysis & Design
8. One way slab Analysis & Design
9. Two way slab Analysis & Design

10. Retaining wall Analysis & Design
11. Simple Tower Analysis & Design
12. Isolated Footing Analysis & Design

REFERENCE BOOKS:

1. "Computer Aided Drafting Lab Manual", Dr. M. N. Sesha Prakash and Dr. C. S. Suresh

Course Code	GEOTECHNICAL ENGINEERING LAB		L	T	P	C
21A010419			0	0	3	1.5
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To know the various characteristics of soils
- To carry out laboratory tests and to identify soil as per IS Codal procedures
- To perform laboratory tests to determine index properties of soil
- To perform tests to determine shear strength
- To perform consolidation test to determine the characteristics of soils

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify various soils based on their characteristics. **(K2)**
CO2: Determine plasticity characteristics of various soils. **(K3)**
CO3: Determine the Optimum Moisture Content of the various soil. **(K3)**
CO4: Evaluate Shear Strength of the various soil by performing test **(K4)**
CO5: predict the settlement of soils by understanding the consolidation process. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	-	-	-	-	3	-	-	3	3	3
CO2	2	3	2	3	-	-	-	-	3	-	-	3	3	3
CO3	2	3	2	3	-	-	-	-	3	-	-	3	3	3
CO4	2	3	2	3	-	-	-	-	3	-	-	3	3	3
CO5	2	3	2	3	-	-	-	-	3	-	-	3	3	3

LIST OF EXPERIMENTS:

1. Specific gravity of soil
2. Grain size analysis by sieving
3. Field density-Core cutter and Sand replacement methods
4. Atterberg's Limits.
5. Proctor Compaction test
6. Permeability of soil - Constant and Variable head tests
7. CBR Test
8. Direct Shear test
9. Unconfined Compression test
10. Vane Shear Test

11. Differential free swell (DFS)
12. Hydrometer Analysis Test (Demonstration)
13. Consolidation test (Demonstration)

REFERENCE BOOKS:

1. "Soil Mechanics and Foundation", B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi publications Pvt. Ltd., New Delhi, 17th Edition, 2017.
2. "Basic and Applied Soil Mechanics", Gopal Ranjan & A. S. R. Rao, New age International Pvt . Ltd, New Delhi, 3rd Edition, 2016.
3. "Principles of Geotechnical Engineering", Braja M. Das, Cengage Learning

Course Code	ADVANCED SURVEYING LAB		L	T	P	C
21A010702			1	0	2	2
Pre-requisite	Surveying	Semester	V			

COURSE OBJECTIVES:

- To provide knowledge of Total Station.
- To develop skills in using Total Station and analyse data.
- To develop skills to find height & distances using total Station
- To develop skills to conduct traverse survey & to find the area

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Calculate areas using Total Station at field level **(K4)**

CO2: Calculate the heights by using Total Station **(K4)**

CO3: Calculating Distance, gradient, diff, height between two inaccessible points using total station **(K4)**

CO4: Export and analyze the data using Software **(K6)**

CO-POMAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	3	-	-	-	-	-	2	2	2	2
CO2	3	2	-	2	3	-	-	-	-	-	2	2	2	2
CO3	3	2	-	2	3	-	-	-	-	-	2	2	2	2
CO4	3	2	-	2	3	-	-	-	-	-	2	2	2	2
CO5	3	2	-	2	3	-	-	-	-	-	2	2	2	2

LIST OF EXPERIMENTS:

1. Introduction to total station and its parts and Functions.
2. Total Station Levelling and Centering
3. Total Station Setup Methods
   - Orientation with angle
   - Orientation with coordinates
   - Free station
4. Calculation of horizontal distance and Calculation of angle between two lines
5. Determination of area using total station
6. Traversing using total station

7. Contouring using total station
8. Determination of remote height using total station
9. Stake-out using total station
10. Distance, gradient, diff, height between two inaccessible points using total station
11. How to export Data from Total station

REFERENCE BOOKS:

1. "Advanced Surveying: Total Station, GIS and Remote Sensing", Gopi and N. Madhu
2. "Surveying & Leveling", Subramanian, Oxford University Press, 2nd Edition
3. "Surveying: Vol. II. and III", Dr. B. C. Punmia, Laxmi Publication, New Delhi.
4. "Surveying and Levelling Vol. II", T. P. Kanetkar and S. V. Kulkarni Pune Vidyarthi Publication.
5. "Principles of Geographical Information System", Burrough, Oxford University Press
6. "Surveying", M. D. Saikia, PHI Learning Pvt. Ltd. Delhi
7. "Surveying Vol. 2", S. K. Duggal, McGraw Hill Publication

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105104100
2. https://nptel.ac.in/courses/105107158

Course Code	UNIVERSAL HUMAN VALUES (Common to all branches)		L	T	P	C
21A000003			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Identify the significance and need of values in the society. **(K2)**

CO2: Understand the meaning of Harmony in the Self the Co-existence of Self and Body. **(K2)**

CO3: Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society **(K2)**

CO4: Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. **(K3)**

CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-

UNIT – I (9 Hrs)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the significance and need of values in the society. (L2)

UNIT – II (9 Hrs)

Understanding Harmony in the Human Being - Harmony in Myself: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programs to ensure self-regulation and Health.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the meaning of Harmony in the Self the Co-existence of Self and Body. (L2)
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. (L2)

UNIT – III (9 Hrs)

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order

Learning Outcomes: At the end of this unit, students should be able to

- Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society (L2)

UNIT – IV (9 Hrs)

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at all Levels, and the Holistic Perception of Harmony in Existence.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. (L3)

UNIT – V (9 Hrs)

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Learning Outcomes: At the end of this unit, students should be able to

- Identify the scope and characteristics of people friendly and eco-friendly production systems. (L2)
- Develop appropriate technologies and management patterns for above production systems. (L3)

- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. (L3)

TEXTBOOKS:

1. "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

REFERENCE BOOKS:

1. "Jeevan Vidya: Ek Parichaya", A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. "Human Values", A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. "The Story of My Experiments with Truth", Mohandas Karamchand Gandhi
5. "Small is Beautiful", E. FSchumacher.
6. "Slow is Beautiful", Cecile Andrews
7. "Economy of Permanence", J C Kumarappa
8. "Bharat Mein Angreji Raj", Pandit Sunderlal
9. "Rediscovering India", Dharampal,
10. "Hind Swaraj or Indian Home Rule", Mohandas K. Gandhi,
11. "India Wins Freedom", Maulana Abdul Kalam Azad
12. "Vivekananda", Romain Rolland (English)
13. "Gandhi", Romain Rolland (English)

ONLINE LEARNING RESOURCES:

1. http://www.uhv.org.in/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://www.studocu.com/in/document/dr-apj-abdul-kalam-technical-university/universal-human-valuestechnical-communication/uhv-best-notes/31376289

Course Code	DESIGN OF STEEL STRUCTURES		L	T	P	C
21A010420			3	0	0	3
Pre-requisite	Advanced strength of materials	Semester	VI			

COURSE OBJECTIVES:

- To understand the steel structures, its basic components and steel fasteners like welding and bolting as per relevant IS code provision
- To impart knowledge procedures of tension and compression members.
- To understand design of column bases
- To learn about the design procedures of Beams
- To impart knowledge in design procedure for eccentric connections
- To understand the design Plate Girders with curtailment of flanges.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Choose the basic concepts of elements of steel structures steel fasteners and design of tension members as per IS -800. **(K4)**

CO2: Design basic and built-up sections of steel compression members adopting IS Code. **(K6)**

CO3: Analyze and design various types of beams under different loads adopting IS Code. **(K4)**

CO4: Design various Eccentric connections under different loads adopting IS Code. **(K6)**

CO5: Analyze and Design plate girders under different loads adopting IS Code. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	1	-	-	-	2	1	3	3
CO2	3	2	3	-	-	-	1	-	-	-	2	1	3	3
CO3	3	2	3	-	-	-	1	-	-	-	2	1	3	3
CO4	3	2	3	-	-	-	1	-	-	-	2	1	3	3
CO5	3	2	3	-	-	-	1	-	-	-	2	1	3	3

UNIT – I (9 Hrs)

Concepts of Plasticity, Yield strength of steel. Loads and combinations, wind loads on roof trusses, Concept of limit State Design of steel structures – Different Limit States as per IS 800 - Bolted connections – Welded connections – Design Strength – Efficiency of joint –Types of Welded joints - Design of bolted and welded eccentric connections with brackets

Learning Outcomes: At the end of this unit, students should be able to

- Analyse bolted and welded connections(L4)
- Estimate strength of welds(L5)
- Design Welded and Bolted connections as per IS Codal provisions (L6)

UNIT – II (9 Hrs)

Design of Tension Members, Splices and design of lug angles

Learning Outcomes: At the end of this unit, students should be able to

- Design Tension Members as per IS Codal provisions (L6)
- Design Lug angles as per IS Codal provisions (L6)

UNIT – III (9 Hrs)

Design of Steel Compression Members – Buckling class – effective length of columns - slenderness ratio Design Strength of columns – Design of Built-up columns with lacing and/or battening system

Design of Column Bases – Slab base only.

Learning Outcomes: At the end of this unit, students should be able to

- Design compression members under different conditions adopting IS Code. (L6)
- Design and detail of built-up columns and column bases adopting IS Code. (L6)

UNIT – IV (9 Hrs)

Design of Beams – Plastic moment – Bending and shear strength, design of laterally supported beams –Built up sections – Large plates Web buckling, Crippling and Deflection of beams, Design of Purlins

Learning Outcomes: At the end of this unit, students should be able to

- Understand behavior of simple and compound beams(L2)
- Design and detail of steel beams under different conditions adopting IS Code. (L6)
- Design simple roof truss elements(L6)

UNIT – V (9 Hrs)

Plate Girder: Design consideration – I S Code recommendations - Design of welded plate girder –Curtailment of flange plates- stiffeners.

Learning Outcomes: At the end of this unit, students should be able to

- Design and detail of components of plate girder confirming to IS Code(L6)
- Design of curtailment of flange plates(L6)

Codes/Tables: IS Codes:

1) IS -800 – 2007
2) IS – 875 – Part III
3) Steel tables to be permitted into the examination hall.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B.

Part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions on design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

TEXTBOOKS:

1. “Limit state design of Steel Structures”, N Subramanyam, Oxford University press, New Delhi, 2nd Edition, 2018
2. “Limit State Design of steel structures”, S.K. Duggal, Tata Mcgraw Hill, New Delhi, 3rd Edition, 2019

REFERENCE BOOKS:

1. “Structural Design and Drawing”, N. Krishna Raju, University Press, Hyderabad, 3rd Edition, 2009
2. “Structural design in steel”, Sarwar Alam Raz, New Age International Publishers, New Delhi
3. “Design of Steel Structures”, Edwin Gaylord, Charles Gaylord, James Stallmeyer, Tata McGraw-Hill, New Delhi.

ONLINE LEARNING RESOURCES:

1. http://www.infocobuild.com/education/audio-video-courses/architectural-and-civil-engineering/design-of-steel-structures-iit-kharagpur.html

Course Code	TRANSPORTATION ENGINEERING		L	T	P	C
21A010421			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart knowledge on highway development.
- To teach concepts of Geometric design and alignment.
- To throw light on different traffic surveys.
- To teach design of highway intersections
- To impart knowledge on highway materials and design of pavements.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the importance of highways in economic development of nation, history of road development in India and various road development plans. **(K2)**

CO2: Identify the importance of geometric various elements of highway. **(K2)**

CO3: Identify the importance of traffic studies, regulation and management for highway design. **(K2)**

CO4: Analyze the traffic and design the suitable system at intersections. **(K4)**

CO5: Differentiate between types of pavements and their design features. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Highway Development and Planning: Highway development in India – Necessity for Highway Planning- Road Development Plans- Classification of Roads - Road Network Patterns – Highway Alignment and Influencing Factors- Engineering Surveys.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the importance of highway planning and development(L2)
- Classify highways based on the importance (L2)

UNIT – II (9 Hrs)

Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements-Sight Distance Elements- Stopping sight Distance, Overtaking

Sight Distance and intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment- Gradients- Vertical curves.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the importance of highway geometric design. (L5)
- Design vertical and horizontal alignment of highways(L6)

<u>UNIT – III</u> (9 Hrs)

Traffic Engineering Studies: Basic Parameters of Traffic-Volume, Speed and Density – Definitions and their inter relation Highway capacity and level of service concept – factors affecting capacity and level of service - Traffic Volume Studies- DatA Collection and Presentation-Speed studies- Data Collection and Presentation- Parking Studies and Parking characteristics- Road Accidents-Causes and Preventive measures- Accident Data Recording – Condition Diagram and Collision Diagrams.

Traffic Regulation And Management: Road Traffic Signs – Types and Specifications – Road markings-Need for Road Markings- Types of Road Markings- Specifications - Design of Traffic Signals –Webster Method – Saturation flow – phasing and timing diagrams – Numerical problems.

Learning Outcomes: At the end of this unit, students should be able to

- Asses the importance of Traffic Surveys for the regulation of traffic. (L5)
- Illustrate the importance of traffic regulation and management. (L4)

<u>UNIT – IV</u> (9 Hrs)

Intersection Design: Conflicts at Intersections- Types of Intersections – Channelization –Traffic Islands and Design At- grade intersections and Grade separated intersections- Rotary Intersection and Design elements.

Learning Outcomes: At the end of this unit, students should be able to

- Asses the importance of various types of intersections. (L4)
- Design various types of systems at intersection for smooth flow at the traffic. (L6)

<u>UNIT – V</u> (9 Hrs)

HIGHWAY MATERIALS AND PAVEMENT DESIGN: Highway materials – Road aggregates-desirable properties-tests on road aggregates. Bituminous materials – tests on bituminous materials. Flexible and Rigid Pavements – Components and Functions – design of Flexible pavement. (G.I method and CBR Method as per IRC 37) –Design of Rigid pavements – Westergaard’s stress equations-CC pavements design-stresses in pavements.

Learning Outcomes: At the end of this unit, students should be able to

- Asses the suitability of highway materials and tests required (L4)

- Analyze the types of pavements and their structural properties. (L4)
- Design of rigid and flexible pavements(L6)

TEXTBOOKS:

1. "Highway Engineering", S. K. Khanna and C. E. G. Justo, Nemchand & Bros., 7th Edition, 2000.
2. "Transportation Engineering (Vol – I)", C. Venkataramaiah, Universities Press Pvt Ltd, Hyderabad.

REFERENCE BOOKS:

1. "Principles and Practice of Highway Engineering Design", L. R. Kadiyali and Lal, Khanna Publications.
2. "Highway Engineering", R. Srinivasa Kumar, Universities Press Pvt Ltd, Hyderabad, 2011.
3. "Highway Engineering", S K Sharma, S. Chand and Company Limited, New Delhi
4. "Transportation Engineering", S P Chandola, S. Chand and Company Limited, New Delhi

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/105101087

Course Code	ENVIRONMENTAL ENGINEERING		L	T	P	C
21A010422			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To provide knowledge on water demand and characteristics of water.
- To teach concept of water treatment and distribution
- To impart knowledge on sewage and collection of sewage.
- To impart knowledge on sewage treatment methodologies
- To provide facts on Air and noise pollution control

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the sources of water, quality of water and water demand. **(K2)**
CO2: Identify appropriate technique for treatment of Drinking water. **(K4)**
CO3: Determine characteristics of sewage. **(K3)**
CO4: Identify appropriate technique for treatment of wastewater. **(K2)**
CO5: Determine consequences of solid waste and its management and Assess the impact of air pollution. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	2	-	-	-	-	-	-	2	2
CO2	2	3	2	-	-	2	2	-	-	-	-	-	2	2
CO3	2	3	2	-	-	-	2	-	-	-	-	-	2	2
CO4	3	3	2	3	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Introduction: Importance and Necessity of Protected Water Supply systems, Objectives of Protected water supply system, Flow chart of public water supply system, Role of Environmental Engineer.

Water Demand and Quantity Studies: Estimation of water demand for a town or city, Types of water demands, Per capita Demand, Factors affecting the Per Capita Demand, Variations in the Demand, Design Period, Factors affecting the Design period, Population Studies, Population Forecasting Studies.

Quality and Analysis of Water: Characteristics of water – Physical, Chemical and Biological. Analysis of Water – Physical, Chemical and Biological. Impurities in water, Water borne diseases. Drinking water quality standards.

Learning Outcomes: At the end of this unit, students should be able to

- Estimate water and demand at various locations. (L3)
- Determine the like physical, chemical, biological characteristics of water (L3)

UNIT – II (9 Hrs)

Water Treatment: Layout and general outline of water treatment units – sedimentation– principles – design factors – coagulation-flocculation clarifier design – coagulants – feeding arrangements. Filtration and Chlorination: Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation comparison of filters – disinfection – theory of chlorination, chlorine demand, other disinfection practices- Miscellaneous treatment methods

Water Distribution: Distribution systems – Requirements, Layout of Water distribution systems - Design procedures- Hardy Cross and equivalent pipe methods service reservoirs – joints, valves such as sluice valves, air valves, scour valves and check valves water meters – laying and testing of pipe lines – pump house, waste detection and prevention.

Learning Outcomes: At the end of this unit, students should be able to

- Explain various stages involved in treatment of water (L5)
- Choose water distribution processes and operation and maintenance of water supply(L5)

UNIT – III (9 Hrs)

Introduction to Sanitation: systems of sanitation – relative merits & demerits – collection and conveyance of waste water – sewerage – classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations – types of sewers – Hydraulics of sewers and storm drains– design of sewers – materials for sewers- appurtenances in sewerage – cleaning and ventilation of sewers .

Waste Water Collection and Characteristics: Conservancy and water carriage systems – sewage and storm water estimation – time of concentration – storm water overflows combined flow – characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D. – C.O.D. equations.

Learning Outcomes: At the end of this unit, students should be able to

- Explain basic designs parameters of water and wastewater treatment plants (L3)
- Determine the sewage characteristics and design various sewage treatment plants(L3)

UNIT – IV (9 Hrs)

Waste Water Treatment: Layout and general outline of various units in a waste water treatment plant – primary treatment: design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – biological treatment – trickling filters – standard and high rate – Construction and design of Oxidation ponds.

Sludge Treatment: Sludge digestion – factors effecting – design of Digestion tank –Sludge disposal by drying – septic tanks and Imhoff Tanks, working principles and design – soak pits.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the Sewage treatment and disposal methods(L5)
- Assess quality of waste water parameters(L5)
- Design waste water treatment systems leading to cleaning of rivers(L6)

UNIT – V (9 Hrs)

Solid Waste Management: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle energy recovery, treatment and disposal).

Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

Noise Pollution: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate the different types of municipal wastes(L4)
- Explain the stages of handling municipals solid wastes(L4)
- Identify causes and types of air pollution(L1)

TEXTBOOKS:

1. “Water Supply and Sanitary Engineering”, G.S. Birdi, Dhanpat Rai & Sons Publishers.
2. “Water Supply Engineering, Vol. 1”, B. C. Punmia, Ashok Jain & Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi
3. “Waste Water Engineering, Vol. II”, B. C. Punmia, Ashok Jain & Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi
4. “Environmental Engineering”, Peavy, TMH Publishers.

REFERENCE BOOKS:

1. “Environmental Science and Engineering”, J. G. Henry and G. W. Heinke, Pearson Education.
2. “Waste Water Treatment - Concepts and Design Approach”, G. L. Karia and R.A. Christian, Prentice Hall of India
3. “Elements of Environmental Engineering”, K. N. Duggal, S. Chand Publishers.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/93/97/9397084/
2. https://ocw.mit.edu/courses/environment-courses/
3. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ge22/

Course Code	FOUNDATION ENGINEERING		L	T	P	C
21A010423			3	0	0	3
Pre-requisite	Geotechnical engineering	Semester	VI			

COURSE OBJECTIVES:

- To determine different soil exploration techniques.
- To determine the earth slope stability.
- To estimate earth pressure using various theories.
- To estimate the contact pressure distribution below shallow footing and allowable bearing pressure.
- To analyze the load carrying capacity of pile foundation and well foundation.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe about the of the soil exploration techniques and soil sampling **(K2)**

CO2: Analyze the stability of earthen slopes. **(K4)**

CO3: Estimate earth pressure using various theories. **(K4)**

CO4: Estimate the contact pressure distribution below shallow footing and allowable bearing pressure. **(K4)**

CO5: Analyze the load carrying capacity of pile foundation and well foundation**(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	2	-	-	-	-	-	-	2	2
CO2	2	3	2	-	-	2	2	-	-	-	-	-	2	2
CO3	2	3	2	-	-	-	2	-	-	-	-	-	2	2
CO4	3	3	2	3	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Soil Exploration: Need – Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests – Plate load test – Pressure meter – planning of Programme and preparation of soil investigation report.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about undisturbed and disturbed soil sampling (L3)
- Determine the bearing capacity of soil using plate load test(L3)

UNIT – II (9 Hrs)

Earth Slope Stability: Infinite and finite earth slopes – Types of failures – Factor of safety of infinite slopes – Stability analysis by Swedish arc method, standard method of slices, Bishop's

Simplified method – Taylor’s Stability Number- Stability of slopes of earth dams under different conditions.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the types of slopes and their failures. (L4)
- Analyze the stability of infinite and finite slopes using various methods. (L4)

UNIT – III (9 Hrs)

Earth Pressure Theories: Rankine’s theory of earth pressure – Earth pressures in layered soils – Coulomb’s earth pressure theory – Rebhann’s and Cullman’s graphical method

Retaining Walls: Types of retaining walls – stability of retaining walls.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the role earth pressure on the stability of retaining systems. (L4)
- Analyze various earth pressure theories (L4)

UNIT – IV (9 Hrs)

Shallow Foundations: Types – choice of foundation – Location of depth – Safe Bearing Capacity – Terzaghi`s, Meyerhoff’s and Skempton`s Methods

Allowable Bearing Pressure: Safe bearing pressure based on N- value – Allowable bearing pressure; safe bearing capacity and settlement from plate load test – Allowable settlements of structures – Settlement Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about various types of foundations(L4)
- Calculate the bearing capacity and settlement of foundations(L4)

UNIT – V (9 Hrs)

Pile Foundation: Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae – Pile load tests – Load carrying capacity of pile groups in sands and clays – Settlement of pile groups.

Well Foundations: Types – Different shapes of wells – Components of wells – functions and Design Criteria – Sinking of wells – Tilts and shifts.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the behavior of the piles under different loading conditions. (L4)
- Design the load carrying capacity of piles. (L6)
- Analyze the behavior of well foundations. (L4)

TEXTBOOKS:

1. “Geotechnical Engineering”, C. Venkataramaiah, New Age Pubilications, 4th Edition, 2002

2. "Soil Mechanics and Foundation Engineering", Arora, Standard Publishers and Distributors, Delhi, 7th Edition, 2009
3. "Soil Mechanics and Foundations", B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi, 17th Edition, 2017

REFERENCE BOOKS:

1. "Soil Mechanics and Foundation Engineering", Purushtoma Raj, Pearson Publications, 2nd Edition, 2013
2. "Principles of Foundation Engineering", B. M. Das, Thomson Engineering, 6th Edition (Indian Edition), 1999
3. "Foundation Engineering", P.C. Varghese, Prentice Hall of India, New Delhi.
4. "Foundation Engineering", V. N. S. Murthy, CRC Press, New Delhi.
5. "Foundation Analysis and Design", J.E. Bowles, McGraw-Hill Publishing company, New York, 4th Edition.
6. "Geotechnical Engineering", Manoj Dutta & Gulati S.K, Tata McGraw Hill Publishers New Delhi, 4th Edition, 1988.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/11296068

Course Code	RAILWAY, AIRPORT AND HARBOUR ENGINEERING		L	T	P	C
21A010424			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To explain the components of permanent way its components their functions and requirements.
- To explain the geometric design of Railway track elements like cant, radius and degree of curve etc. and their design components.
- To understand about Aircraft characteristics and their influence on various design elements of an airport.
- To impart the concepts of runway orientation, Airport lighting, Airport components their planning and geometric design of runways and taxiways.
- To explain the difference between ports and Harbours, types of Ports and Harbours, various facilities needed in Ports and Harbours and Navigational Aids for ships.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the components of permanent way its components and their functions and requirements. **(K2)**

CO2: Describe the geometric design elements of Railway track like cant, radius of curve and degree of curve. **(K2)**

CO3: Explain the Aircraft characteristics and their influence on various design elements of and Airport. **(K2)**

CO4: Illustrate the concepts of runway orientation, Airport planning and geometric design of runways and taxiways. **(K2)**

CO5: Identify the difference between ports and Harbors, various facilities needed in Ports and Harbors and Navigational Aids for ships. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Railway Engineering: Introduction – Permanent way components – Cross section of permanent way – Functions and requirements of rails, sleepers and ballast – Types of gauges – Creep of rails – Theories related to creep – Coning of wheels – adzing of sleepers – Rail fastenings

Learning outcomes: At the end of this unit, students should be able to

- Explain about railway track components, materials and fixtures and fastenings(L3)
- Estimate various functions & requirements of rails(L5)

<u>UNIT – II</u> (9 Hrs)

Geometric Design of Railway Track: Gradients – Grade compensation – Cant and negative super elevation – Cant deficiency – Degree of curves – Safe speed on railway track – Points and crossings – Layout and functioning of left hand turn out and right hand turn outs – Station yards – Signaling and interlocking.

Learning outcomes: At the end of this unit, students should be able to

- Assess various design elements of railway track (L5)
- Develop a layout of different turnouts (L6)

<u>UNIT – III</u> (9 Hrs)

Airport Engineering: Airport site selection – Factors affecting site selection and surveys-Runway orientation – Wind rose diagram – basic runway length – Correction for runway length – Terminal area – Layout and functions – Concepts of terminal building – Simple building , Linear concept, pier concept and satellite concept – Typical layouts .

Learning outcomes: At the end of this unit, students should be able to

- Assess the Aircraft characteristics and their influence on various design elements of an Airport (L5)
- Determine the factors for layouts of airport terminal(L3)

<u>UNIT – IV</u> (9 Hrs)

Geometric Design of Runways and Taxiways: Aircraft characteristics – Influence of characteristics on airport planning and design – Geometric design elements of runway – Standards and specifications - Functions of taxiways – Taxiway geometric design – Geometric elements and standard specifications – Runway and taxiway lighting.

Learning outcomes: At the end of this unit, students should be able to

- Design the runway various elements of runway (L6)
- Explain the Runway and taxiway lighting. (L3)

<u>UNIT – V</u> (9 Hrs)

Ports and Harbors: Harbors - Requirements of ports and harbors – Types of ports – Classification of harbors – Docks and types of docks – Dry docks, wharves and jetties – Breakwaters: layouts of different types of harbors and docks – Dredging operations – navigation aids.

Learning outcomes: At the end of this unit, students should be able to

- Illustrate the difference between ports and Harbours(L3)
- Explain the facilities needed in Ports and Harbours and Navigational Aids for ships(L3)

TEXTBOOKS:

1. "Transportation Engineering: Railways, Airports, Docks and Harbours", R Srinivasa Kumar, Universities Press, 2014
2. "Airport Planning and Design", S.K. Khanna and M.G Arora, Nemchand Bros, 6th Edition
3. "Dock and Harbour Engineering", Hasmukh P Oza, Gutam H Oza, Charotar Publishers pvt ltd.
4. "Railway Engineering", Satish Chandra and Agarwal, M.M. Oxford Higher Education, University Press New Delhi, 2007 .

REFERENCE BOOKS:

1. "Highway, railway, Airport and Harbour Engineering", K.P. Subramanian, Scitech publishers.
2. "Harbour, Dock and Tunnel Engineering", R. Srinivasan, Charotar Publishing House Pvt. Limited, 2009
3. "Railway Track Engineering", J. S. Mundrey, McGraw Hill Education, 5th Edition, 2017
4. "Transportation Engineering", S. P. Chandola, S. Chand & Co. Ltd., 2001.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/9597123

Course Code	**REHABITATION & RETROFITTING OF STRUCTURES**		**L**	**T**	**P**	**C**
21A010425			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To explain different types of deterioration of structures, distress in structures and damage mechanism.
- To understand the aspects of repair and rehabilitation and facets of maintenance.
- To apply the various techniques of repair for corrosion protection in structures.
- To illustrate different methods for strengthening the existing structures and methods of demolition of structures using engineered and non-engineered techniques.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the strength and materials deficiency in concrete structures. **(K3)**
CO2: Explain about the causes, mechanism and prevention against damaged of existing structures **(K3)**
CO3: Apply Non-Destructive Testing techniques to field problems **(K3)**
CO4: Apply cost effective retrofitting strategies for repairs in buildings **(K3)**
CO5: Apply health monitoring methods to the structures **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	-	2	-	-	-	-	-	2	2
CO2	2	2	2	2	-	2	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Introduction: Deterioration of Structures – Distress in Structures – Causes and Prevention. Mechanism of Damage – Types of Damage

Learning Outcomes: At the end of the course, the students should be able to

- Assess the strength and materials deficiency in concrete structures (L5)
- Evaluate prevention methods to the damaged structures(L5)

UNIT – II (9 Hrs)

Corrosion of Steel Reinforcement: Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation.

Learning Outcomes: At the end of the course, the students should be able to

- Explain about the methods and techniques used in repairing / strengthening of existing concrete structures (L3)
- Analyze the damage of structures due to fire. (L4)

UNIT – III (9 Hrs)

Inspection and Testing: Symptoms and Diagnosis of Distress – Damage assessment – NDT.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Non-Destructive Testing techniques to field problems (L3)
- Analyze the inspection methods and testing methods (L4)
- Apply diagnosis to distressed structures (L3)

UNIT – IV (9 Hrs)

Repair of Structure: Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing.

Learning Outcomes: At the end of this unit, students should be able to

- Apply cost effective retrofitting strategies for repairs in buildings (L3)
- Apply strengthening methods for buildings(L3)

UNIT – V (9 Hrs)

Health Monitoring of Structure: Use of Sensors – Building Instrumentation.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the health monitoring methods to the structures(L4)
- Asses the usage of Sensors in buildings(L6)

TEXTBOOKS:

1. “Concrete Technology Theory and Practice”, M. S. Shetty, S. Chand and Company, New Delhi
2. “Concrete Technology”, A.R. Santakumar, Oxford University press
3. “Maintenance and Repair of Civil Structures”, B.L. Gupta and Amit Gupta, Standard Publications.
4. “Non-Destructive Evaluation of Concrete Structures”, Bungey, Surrey University Press

REFERENCE BOOKS:

1. “Diagnosis And Treatment of Structures In Distress”, R. N. Raikar, Published By R&D Centre Of Structural Designers & Consultants Pvt.Ltd., Mumbai, 1994.

2. “Handbook On Repair and Rehabilitation of RCC Buildings”, Published By CPWD, Delhi, 2002.
3. “Earthquake Resistant Design of Structures”, Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India, 2006.

ONLINE LEARNING RESOURCES:

1. https://archive.nptel.ac.in/courses/95/95/9595213/
2. https://nptel.ac.in/courses/9596202
3. http://www.alljntuworld.in/wp-content/uploads/2016/01/Rehabilitation-and-RetrofittingofStructuresNotes.pdf

Course Code	ENVIRONMENTAL ENGINEERING LAB		L	T	P	C
21A010426			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To estimate various parameters like PH, Chlorine Sulphates, and Nitrates etc.., in water. For effective water treatment
- To determine optimum dosage of coagulant and chloride demand.
- To determine total dissolved solids and iron content present in the water.
- To estimate status of Industrial effluents (BOD and COD of effluent).

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Test the water and wastewater quality, and know which tests are appropriate for given environmental problems. **(K6)**

CO2: Apply the laboratorial results to problem identification, quantification, design and technical solutions **(K4)**

CO3: Identify use the water and wastewater sampling procedures and sample preservations. **(K2)**

CO4: Assess the impact of water and wastewater treatment on people and the environment **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	-	3	-	3	-	-	-	3	-	3	3	3
CO2	-	3	-	3	-	3	-	-	-	3	-	3	3	3
CO2	-	3	-	3	-	3	-	-	-	3	-	3	3	3
CO4	-	3	-	3	-	3	-	-	-	3	-	3	3	3

LIST OF EXPERIMENTS:

1. Determination of Ph and Turbidity
2. Determination of conductivity and Total dissolved solids
3. Determination and Estimation of Total Hardness
4. Determination of Alkality/Acidity
5. Determination of Chlorides.
6. Determination and Estimation of Total solids, Organic solids and inorganic solids
7. Determination of iron.
8. Determination of Dissolved Oxygen
9. Determination of nitrogen
10. Determination of total phosphorous
11. Determination of B.O.D
12. Determination of C.O.D

13. Determination of Optimum coagulant dose
14. Determination of chlorine demand
15. Presumption coliform test

REFERENCE BOOKS:

1. “Chemistry for Environmental Engineering”, Sawyer and McCarty
2. “Standard Methods for Analysis of water and Waste Water”, APHA
3. “Environmental Engineering Lab Manual”, Dr. G. Kotaiah and Dr. N. Kumara Swamy, Charotar Publishers

Course Code	TRANSPORTATION ENGINEERING LAB		L	T	P	C
21A010427			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To make the students familiar with principles and procedures of testing of highway materials.
- To provide hands-on experience for the students on different Tests needed to be conducted on Aggregates and Bitumen to find out their suitability for Road Works.
- To conduct standard tests for bitumen pavement design and paving materials in order to assess their engineering properties and behavior.
- To relate material characteristics to various application of construction.
- To understand the test procedures for characterization of aggregates and bituminous mixes

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Categorize the test on materials used Civil Engineering Building & Pavement constructions features. **(K4)**

CO2: Identify engineering properties of aggregate **(K2)**

CO3: Identify the grade & properties of bitumen. **(K2)**

CO4: Examine the tests performed for Bitumen mixes. **(K3)**

CO5: To select appropriate materials for highway construction based on material characteristics, engineering properties, design requirements, cost, availability, and expected service life. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	1	-	-	-	-	2	2
CO2	3	3	3	2	-	-	-	1	-	-	-	-	2	2
CO3	3	2	3	2	-	-	-	1	-	-	-	-	2	2
CO4	3	3	1	2	-	-	-	1	-	-	-	-	2	2
CO5	3	3	1	2	-	-	-	1	-	-	-	-	2	2

LIST OF THE EXPERIMENTS:

TESTS ON ROAD AGGREGATES:

1. Aggregate Crushing value Test.
2. Aggregate Impact Test.
3. Abrasion Test.
4. Shape tests
5. Specific Gravity and water Absorption

TESTS ON BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.

3. Softening Point Test.
4. Flash and fire point tests.
5. Demo on Marshall Stability Test on Bituminous Mixes

TEXTBOOKS:

1. "Highway Material Testing and Quality Control", G. Venkatappa Rao, K. Ramachandra Rao, Kausik Pahari, D.V.

Course Code	BIM USING REVIT ARCHITECTURE		L	T	P	C
21A010428			**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To learn the essential concepts of BIM and the basic technical skills to create and manipulate a BIM model
- To retrieve information from a BIM model and how to use common modelling tools.
- To train students on the broad and expanding field of BIM applications by providing a general lexicon
- To efficiently implement the BIM process to coordinate and communicate design intents as well as to convey data necessary for further building analysis
- To provide a comprehensive overview of the main BIM applications currently in use

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze construction schedules and logistics using BIM to communicate and evaluate project activities **(K4)**

CO2: Apply BIM for build ability scenario forecasting, including interference management and clash detection **(K3)**

CO3: Assess low/zero-carbon and renewable technologies **(K5)**

CO4: Apply BIM and low/zero carbon technology to evaluate building environmental performance **(K3)**

CO5: Understand comprehensive overview of the main BIM applications currently in use, in order to develop a critical approach to these techniques **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3	2	-	-	-	-	-	2	2	2
CO2	2	2	3	3	3	-	-	-	-	-	-	2	2	2
CO3	2	2	3	3	3	2	-	-	-	-	-	2	2	2
CO4	2	2	3	2	3	2	-	-	-	-	-	2	2	2
CO5	2	2	3	3	3	2	-	-	-	-	-	2	2	2

LIST OF EXPERIMENTS:

1. Introduction to REVIT Architecture
2. Planning and modelling the initial design
3. Creating and editing walls
4. Creating and editing doors, windows and ventilators
5. Creating and editing beams and columns
6. Creating and editing footing and floors

7. Creating and editing staircase
8. Creating ceiling, railing
9. Draw plan through curtain system
10. Planning and modelling 2 BHK residential buildings
11. Planning and modelling commercial buildings
12. Planning and modelling warehouse

REFERENCE BOOKS:

1. "BIM Handbook: A Guide to Building Information Modeling", Chuck Eastman, et al.
2. "Building Information Modeling: A Strategic Implementation Guide", Dana K. Smith and Michael Tardif
3. "Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations", Willem Kymmell
4. "BIM & Construction Management: Proven Tools, Methods, & Workflows",Brad Hardin

ONLINE LEARNING RESOURCES:

1. https://www.coursera.org/lecture/bim-fundamentals/203-necessity-of-bim-u4nue

Course Code	ESTIMATION, COSTING AND VALUATION		L	T	P	C
21A010703			1	0	2	2
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand basics on methods and types of estimation.
- To formulate specifications and tender documents.
- To impart knowledge on Preparation of contract agreements
- To teach about rate analysis of different items.
- To impart knowledge on Valuation of buildings.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain different methods of estimation **(K2)**
CO2: Compute the earth work for roads and canals. **(K3)**
CO3: Prepare tenders & contracts for various construction works. **(K3)**
CO4: Collect and analyze data for preparation of bills abstract estimation **(K3)**
CO5: Prepare the valuation of buildings. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	2

MODULE – I

Estimation: Methods of estimation-advantages-types of estimates-detailed estimates of residential buildings-single storied and multi-storied buildings-earthwork-foundations-Super structure-Fittings including sanitary and electrical fittings-paintings.

MODULE – II

Earth Work Estimation: Earthwork for roads and canals

Specifications: Detailed and general specifications-construction specifications-sources- types of specifications

MODULE – III

Tenders & Contracts: Tender notices-types-corrigendum notice-tender procedures Drafting model Tenders. Types of contracts-formation and conditions of contract-problems-contract for labor, material, design and construction-drafting of contract documents-construction contracts-arbitration and legal requirements.

MODULE – IV

Rate Analysis And Preparation Of Bills: Data-Rate analysis-abstract estimate-report to accompany estimate-measurement book –bills- types

MODULE – V

Valuation: Principles of valuation-Value and Cost-value engineering-value analysis - phases In value engineering-information-function-escalation-evaluation-recommendation-implementation-Audit.

LIST OF EXPERIMENTS:

1. Estimation of a building – long wall & short wall method
2. Estimation of a building – center line method
3. Estimate quantity of Earth work for roads
4. Estimate quantity of Earth work for canals
5. Analysis of rate of concrete work
6. Analysis of rate of brick work
7. Analysis of rate of plaster work
8. Estimate quantity of reinforcement
9. Prepare bill of quantities of given item from actual measurements
10. Perform the rate analysis for a project as per SSR
11. Estimate the cost of a building by plinth area method
12. Quote a tender for a project with necessary specifications

TEXTBOOKS:

1. "Estimating and Costing in Civil Engineering (Theory & Practice)", B. N. Dutta, UBS Publishers, 28th Edition, 2020
2. "Civil Engineering Contracts and Estimates", B. S. Patil, Universities Press Pvt Ltd, Hyderabad, 4th Edition, 2015.

REFERENCE BOOKS:

1. "Estimation, Costing and Specifications", M. Chakraborthi, Laxmi publications, 2010
2. "A Textbook of Estimating and Costing (Civil)", D. D. Kohli & R. C. Kohli, S. Chand and Company Limited, New Delhi
3. Standard Schedule of rates and standard data book by public works department.
4. Daily Schedule of rates and standard data book by public works department.
5. I. S. 1200-1 (Parts I to XXV, "Method of Measurement of Building and Civil Engineering

works – B.I.S.)", 1992

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105103093
2. https://nptel.ac.in/courses/129106006

<table>
<tr><td>Course Code</td><td rowspan="2">RESEARCH METHODOLOGY
(Common to all branches)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A000004</td><td>2</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="3">VI</td></tr>
</table>

COURSE OBJECTIVES:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Know how to define a Research problem, select suitable design and experimental approach. **(K1)**
CO2: Formulate sampling design and various techniques implemented on data collection. **(K6)**
CO3: Correlate any two variables and find the solution using regression analysis. **(K4)**
CO4: Examine hypothesis testing procedure, Analyze the significance of variance and covariance. **(K4)**
CO5: Write a report on research work for seminars, conferences formats. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (6 Hrs)

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of research and its process. (L2)
- Explain various types of research. (L2)
- Explain the steps involved in research design. (L2)
- Understand the different research approaches. (L2)

UNIT – II (6 Hrs)

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of sampling and sampling design. (L2)
- Explain various techniques in measurement and scaling. (L2)
- Understand various methods of data collection. (L2)
- Design survey questionnaires for different kinds of research. (L3)
- Analyze the questionnaires. (L4)

UNIT – III (6 Hrs)

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of correlation and regression. (L2)
- Compare and contrast correlation and regression. (L3)
- Explain various types of correlation. (L3)
- Apply the knowledge of C&R Analysis to get the results. (L3)

UNIT – IV (6 Hrs)

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Understand the hypothesis testing procedure. (L2)
- Compare and contrast Parametric and Non-parametric Tests. (L3)
- Understand the use of chi-square test in investigating the distribution of categorical variables. (L2)
- Analyze the significance of variance and covariance. (L4)

UNIT – V (6 Hrs)

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how to write a report and research paper. (L2)
- Explain various techniques of interpretation. (L2)
- Understand the importance of professional ethics in research. (L2)
- Design a scientific paper to present in the conferences/seminars. (L3)

TEXTBOOKS:

1. "Research Methodology: Methods and Techniques", C.R.Kothari, New Age International Publishers, 2nd Edition,.
2. "Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, Sage Publications

REFERENCE BOOKS:

1. "Research Methodology and Statistical Tools", P. Narayana Reddy and G. V. R. K. Acharyulu, Excel Books, New Delhi, 1st Edition.
2. "Business Research Methods", Donald R. Cooper & Pamela S Schindler, 9th Edition.
3. "Fundamentals of Statistics", S C Gupta, Himalaya Publications, 7th Edition

Course Code	BRIDGE ENGINEERING		L	T	P	C
21A010429			3	0	0	3
Pre-requisite	Design of Reinforced Concrete Structures	Semester	VII			

COURSE OBJECTIVES:

- To introduce the students to choose the appropriate bridge type for a given project, and to analyses and design the main components of the chosen bridge
- To teach the students the method of designing a deck slab bridge for class AA loading
- To teach the students about the general features of a beam and slab bridge and various methods for design of interior panel for class AA loading
- To familiarize the students with components of plate girder bridges and their design procedure
- To introduce students the importance and stability analysis procedure of piers and abutments subjected to various forces

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the load-carrying capacity of various types of bridges, upon learning the structural responses to different kinds of loads. **(K3)**

CO2: Analyze the deck slab bridge for the given loading and detail the box culverts. **(K3)**

CO3: Design short and medium span bridges, with confidence using existing codes **(K6)**

CO4: Explain the importance of plate girder bridges and their design procedure **(K2)**

CO5: Perform stability analysis for substructures components like piers and abutments, wing walls Beam. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	-	-	2	2
CO2	2	2	2	2	-	-	-	-	-	-	-	-	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	2	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Introduction: Importance of site investigation in Bridge design. Highway Bridge loading standards. Impact factor. Railway Bridge loading standards (B.G. ML Bridge) various loads in bridges.

Box Culvert: General aspects. Design loads, Design of Box culvert subjected to RC class AA tracked vehicle only.

Bridge Bearings: General features – Types of Bearings – Design principles of steel Rocker & Roller Bearings – Design of a steel Rocker Bearing – Design of Elastomeric pad Bearing.

Learning Outcomes: At the end of this unit, students should be able to

- Compare the different types of I.R.C loads on the bridges. (L5)
- Select the different types of bridge bearings based on their suitability. (L5)

UNIT – II (9 Hrs)

Deck Slab Bridge: Introduction – Effective width method of Analysis Design of deck slab bridge (Simply supported) subjected to class AA Tracked Vehicle only.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the deck slab bridges subjected to class AA loading (L3)
- Design of the deck slab bridges for class AA loading(L3)

UNIT – III (9 Hrs)

Beam & Slab Bridge (T-Beam Bridge): General features – Design of interior panel of slab – Pigeauds method – Design of a T-beam bridge subjected to class AA tracked vehicle only.

Learning Outcomes: At the end of this unit, students should be able to

- Express the pigeauds method of analysis of deck slabs of T beam bridges (L6)
- Design the T beam bridges (L6)

UNIT – IV (9 Hrs)

Plate Girder Bridge: Introduction – elements of a plate girder and their design. Design of a Deck type welded plate girder – Bridge of single line B.G.

Learning Outcomes: At the end of this unit, students should be able to

- Express the forces acting on the plate girder bridge(L6)
- Design the elements of plate girder bridge (L6)

UNIT – V (9 Hrs)

Piers & Abutments: General features – Bed Block – Materials piers &Abutments Types of piers – Forces acting on piers – Stability analysis of piers – General features of Abutments – forces acting on abutments – Stability analysis of abutments – Types of wing walls – Approaches – Types of Bridge foundations (excluding Design).

Learning Outcomes: At the end of this unit, students should be able to

- Determine the forces acting on the piers and abutments and their stability analysis. (L3)
- Classify the different types of wings walls. (L4)

Note: Relevant IRC & Railway Bridge Codes are to be permitted in the examination hall

TEXTBOOKS:

1. "Bridge Engineering", Ponnu Swamy, TATA Mcgraw Hill Company, New Delhi, 3rd Edition, 2017.
2. "Design of Bridges", N. Krishnam Raju, Oxford & IBH, Publishing Company Pvt. Ltd., Delhi, 5th Edition, 2019
3. "Essentials of Bridges Structure", D. J. Victor, 6th Edition, 2019.
4. IRC& Railway bridge Codes

REFERENCE BOOKS:

1. "Design of Steel structures", B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi.
2. "Design of Steel structures", Ramachandra.
3. "Design of R.C.C. structures", B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi
4. "Design of Bridges Structure", T. R. Jagadish & M. A. Jayaram, Prentice Hall of India

ONLINE LEARNING RESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105216/
2. https://nptel.ac.in/courses/105105165

Course Code	FINITE ELEMENT METHODS IN CIVIL ENGINEERING APPLICATIONS		L	T	P	C
21A010430			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Formulate the design and heat transfer problems with application of FEM.
- Solve 1 D, 2 D and dynamic problems using Finite Element Analysis approach
- To impart preliminary knowledge of analyzing Civil Engineering problems using Finite Element Methods.
- To learn advanced methods of structural analysis and to apply these methods for analysis of indeterminate structures.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply direct stiffness, Rayleigh-Ritz method to solve engineering problems and outline the requirements for convergence. **(K3)**

CO2: Determine shape functions and stiffness matrices for different elements **(K3)**

CO3: Determine global stiffness matrices and global load vectors. **(K3)**

CO4: Analyze 2D structural problems using CST element and analysis the axi-symmetric problems with triangular element **(K4)**

CO5: Apply numerical methods to FEM **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO4	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO5	2	2	2	2	-	-	-	-	-	-	-	2	2	2

UNIT – I (9 Hrs)

Introduction: Concepts of FEM – Steps involved – Merits & Demerits – Energy Principles – Discretization – Rayleigh –Ritz method of functional approximation.

Principles of Elasticity: Equilibrium equations – strain displacement relationships in matrix form – Constitutive relationships for plane stress, plane strain and Axi-symmetric bodies of revolution with axi-symmetric loading.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of nodes and elements. (L4)
- Explain the general steps of finite element methods. (L4)

UNIT – II (9 Hrs)

One Dimensional & Two-Dimensional Elements: Stiffness matrix for bar element – shape functions for one dimensional elements – one dimensional problems. Two Dimensional Elements - Different types of elements for plane stress and plane strain analysis – Displacement models – generalized coordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates conditions.

Learning Outcomes: At the end of this unit, students should be able to

- To explain the role and significance of shape functions in finite element formulations (L4)
- Formulate and solve axially loaded bar problems. (L6)

UNIT – III (9 Hrs)

Generation of Element: Generation of element stiffness and nodal load matrices for 3-node triangular element and four noded rectangular elements.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the use of the 3-node triangular element and four noded rectangular elements (L4)
- Formulate and analyze 3-node triangular element and four noded rectangular elements. (L6)

UNIT – IV (9 Hrs)

Isoparametric Formulation: Concepts of, isoparametric elements for 2D analysis–formulation of CST element, 4 –Noded and 8-noded iso-parametric quadrilateral elements – Lagrangian and Serendipity elements.

Axi-Symmetric Analysis: Basic Principles-Formulation of 4-noded iso-parametric axi-symmetric element

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of basic iso parametric 4-Noded and 8-Noded elements. (L4)
- Analyse the Axi- Symmetric elements (L4)

UNIT – V (9 Hrs)

Solution Techniques: Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of solution techniques for static load. (L4)

TEXTBOOKS:

1. "Finite Element Analysis for Engineering and Technology", Tirupathi R Chandraputla, Universities Press Pvt Ltd, Hyderabad, 2003.
2. "Finite Element analysis – Theory & Programming", C. S. Krishna Murthy, Tata McGraw Hill Publishers, 2nd Edition, 2017
3. "Finite Element Methods", R. Dhanaraj & K. Prabhakar Nair, Oxford Publishers, Jan 1st 2016

REFERENCE BOOKS:

1. "Finite Element Methods in Civil Engineering", M. Rama Narasimha Reddy, Dr. K. Sreenivasu Reddy, D. Srinivasulu Reddy, Sci-Tech Publications Pvt. Ltd. 4th Edition, 2020
2. "Finite Element Analysis and Procedures in Engineering", H. V. Lakshminaryana, 3rd Edition, Universities Press, Hyderabad.
3. "A First Course in the Finite Element Methods", Daryl Logan, Cengage Publishers.
4. "Finite Element Analysis in Engineering Design", S. Rajasekharan, S. Chand Publications, New Delhi, 2006
5. "Finite Element Analysis", S. S. Bhavakatti, New Age International Publishers, 3rd Edition, 2015

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105106051

Course Code	DESIGN AND DRAWING OF IRRIGATION STRUCTURES		L	T	P	C
21A010431			3	0	0	3
Pre-requisite	Water Resources Engineering	Semester	VII			

COURSE OBJECTIVES:

- To know the design and drawing aspects of Sloping glacis weir,
- To know the design and drawing aspects of Tank sluice with tower head,
- To know the design and drawing aspects of Type III Siphon aqueduct,
- To know the design and drawing aspects of Surplus weir,
- To know the design and drawing aspects of Trapezoidal notch fall and Canal regulator.

COURSE OUTCOMES:

CO1: Design and draw the plan and cross section of Sloping glacis weir. **(K6)**
CO2: Design and draw the plan and cross section of Tank sluice with tower head **(K6)**
CO3: Design and draw the plan and cross section of Type III Syphon aqueduct **(K6)**
CO4: Design and draw the plan and cross section of Surplus weir. **(K6)**
CO5: Design and draw the plan and cross section of Trapezoidal notch fall and Canal regulator **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-

Design and draw the plan and cross-sectional view of following irrigation structures

UNIT – I (9 Hrs)

SLOPING GLACIS WEIR

Learning Outcomes: At the end of this unit, students should be able to

- Design and draw the plan and cross section of sloping glacis weir.(L6)

UNIT – II (9 Hrs)

TANK SLUICE WITH TOWER HEAD

Learning Outcomes: At the end of this unit, students should be able to

- Design and draw the plan and cross section of Tank sluice with tower head(L6)

UNIT – III (9 Hrs)

TYPE III SIPHON AQUEDUCT.

Learning Outcomes: At the end of this unit, students should be able to

- Design and draw the plan and cross section of Type III Syphon aqueduct(L6)

UNIT – IV (9 Hrs)

TRAPEZOIDAL NOTCH FALL.

Learning Outcomes: At the end of this unit, students should be able to

- Design and draw the plan and cross section of Trapezoidal Notch Fall(L6)

UNIT – V (9 Hrs)

CANAL REGULATOR.

Learning Outcomes: At the end of this unit, students should be able to

- Design and draw the plan and cross section of Canal regulator(L6)

FINAL EXAMINATION PATTERN:

Any two questions of the above five designs may be asked out of which the candidate has to answer one question. The duration of examination will be three hours.

TEXTBOOKS:

1. "Design of minor irrigation and canal structures", C. Satyanarayana Murthy, Wiley eastern Ltd., 3rd Edition, 2013
2. "Irrigation engineering and Hydraulic structures Standard", S.K. Garg, Khanna Publishers, 36th Edition, 2019

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/126105010
2. https://nptel.ac.in/courses/105105110

Course Code	BUILDING CONSTRUCTION MANAGEMENT		L	T	P	C
21A010432			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To make the students familiar with various construction activities, preparing construction schedule and maintaining documents and records of those activities
- To teach the students about various terms and technologies involved in earthwork of construction activities
- To make the students familiar with concepts involved in project management like bar charts and milestone charts
- To teach the students various elements of a network diagram like event, activity and dummy and their importance in network diagrams
- To teach the students the concepts of time estimates involved in CPM and PERT, float and slack, critical path calculations.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the various construction activities like preparing construction schedule and maintaining documents and records of those activities **(K3)**

CO2: Explain the concepts and techniques involved in earthwork activities **(K2)**

CO3: Explain the steps involved in developing a project scheduling and management and the application of bar charts and milestone charts. **(K2)**

CO4: Explain the various elements of a network diagram like event, activity and dummy **(K2)**

CO5: Explain the concepts of calculation of time estimates of CPM and PERT. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Fundamentals of Construction Technology: Definitions and Discussion, Construction Activities, Construction Processes, Construction Works, Construction Estimating, Construction Schedule, Productivity and Mechanized Construction, Construction Documents, Construction Records, Quality, Safety, Codes and Regulations

Preparatory Work and Implementation: Site Layout, Infrastructure Development, Construction Methods, Construction Materials, Deployment of Construction Equipment, Prefabrication in Construction, Falsework and Temporary Works.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss about construction activities, processes, works, estimation and schedule (L6)

UNIT – II (9 Hrs)

Earth Work: Classification of Soils, Project Site, Development, Setting Out, Mechanized Excavation, Groundwater Control, Trenchless (No-Dig) Technology, Grading, Dredging. Rock Excavation, Basic Mechanics of Breakage, Blasting Theory, Drillability of Rocks, Kinds of Drilling, Selection of The Drilling Method and Equipment, Explosives, Blasting Patterns and Firing Sequence, Smooth Blasting, Environmental Effect of Blasting

Learning Outcomes: At the end of this unit, students should be able to

- Prepare detailed and general specifications for a project development (L3)
- Classify different types of soils (L4)

UNIT – III (9 Hrs)

Project management and bar charts and milestone charts: Introduction, Project Planning, Scheduling, Controlling, Role of Decision in Project Management, Techniques for Analyzing Alternatives, Operation Research, Methods of Planning and Programming Problems, Development of Bar Chart, Illustrative Examples, Shortcomings of Bar Charts and Remedial Measures, Milestone Charts, Development of PERT Network Problems

Learning Outcomes: At the end of this unit, students should be able to

- Explain about project planning, scheduling, controlling (L5)
- Develop bar chart (L6)

UNIT – IV (9 Hrs)

Elements of Network and Development of Network: Introduction, Event, Activity, Dummy, Network Rules, Graphical Guidelines for Network, Common Partial Situations in Network, Numbering the Events, Cycles Problems, Planning for network construction, Modes of network construction, Steps in development of network, Work breakdown structure, Hierarchies, Illustrative examples, Problems

Learning Outcomes: At the end of this unit, students should be able to

- Explain the elements of network (L5)
- Plan the number of events and develop the network. (L6)

UNIT – V (9 Hrs)

PERT and CPM – Time Computations and Network Analysis: Introduction, Uncertainties, Use of PERT, Time estimates, Frequency distribution, Mean, variance and standard deviation, Probability distribution, Beta distribution, Expected time Problems, Earliest expected time, Formulation of TE, Latest allowable occurrence time, Formulation for TL, Combined tabular computations for TE and TL problems, Introduction, Slack, Critical path, Illustrative examples, Probability of meeting scheduled date Problems. CPM: Process, CPM: Networks, Activity time estimate, Earliest event time, Latest allowable occurrence time, Combined tabular computations for TE and TL, Start and finish times of activity, Float, Critical activities and critical path, Illustrative examples, Problems

Learning Outcomes: At the end of this unit, students should be able to

- Elaborate the concepts of calculation of time estimates of CPM and PERT (L6)

TEXTBOOKS:

1. "Construction project management", Jha, Pearson Publications, New Delhi, 2nd Edition, 2015
2. "Construction Technology", Subir K. Sarkar and Subhajit Saraswati, Oxford Higher Education Univ. Press, Delhi, 2008 Edition.
3. "Project Planning and Control with PERT and CPM", Dr. B. C. Punmia, K. K. Khandelwal, Lakshmi Publications, New Delhi, 2022 Edition.
4. "Estimating and Costing in Civil Engineering (Theory & Practice)", B. N. Dutta, UBS Publishers, 28th Edition, 2020.
5. "Civil Engineering Contracts and Estimates", B. S. Patil, Universities Press Pvt. Ltd, Hyderabad, 4th Edition, 2015.

REFERENCE BOOKS:

1. "Optimal design of water distribution networks", P. R. Bhave, Narosa publishing house, 2003
2. "Total Project Management, the Indian Context", P.K. Joy, MacMillan Publishers India Ltd.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105104161

Course Code	GROUND IMPROVEMENT TECHNIQUES		L	T	P	C
21A010433			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To impart knowledge on the fundamental concept of ground improvement techniques.
- To impart knowledge of densification methods in cohesive soils & Granular soils
- To understand the concepts of mechanical & chemical stabilization
- To impart knowledge of components of reinforced earth & design of reinforced earth walls.
- To understand problems of expensive soils and foundation techniques on it

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine Various methods of dewatering &grouting techniques for ground improvement **(K3)**
CO2: Identify various densification methods in cohesive & granular soils **(K2)**
CO3: Apply various stabilization techniques for ground improvement **(K3)**
CO4: Explain the function & application of geo member. **(K3)**
CO5: Identify various methods of determination of swell pressure **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1		-	-	-	-	-	-	-	-	3	1
CO2	2	3	1	-	-	-	-	-	-	-	-	-	3	1
CO3	2	3	1	-	-	-	-	-	-	-	-	-	3	1
CO4	2	3	1	-	-	-	-	-	-	-	-	-	3	1
CO5	2	3	1	-	-	-	-	-	-	-	-	-	3	1

UNIT – I (9 Hrs)

Dewatering: Methods of de-watering- Sumps and interceptor ditches- Single, multi stage well points - Vacuum well points- Horizontal wells-foundation drains-blanket drains - Criteria for selection of fill material around drains

Grouting: Objectives of grouting- Grouts and their properties- Grouting methods- ascending, descending and stage grouting- hydraulic fracturing in soils and rocks- Post grout test.

Learning Outcomes: At the end of this unit, students should be able to

- To classify the various grouting techniques and its applications for improving loadbearing of beneath soils (L4)
- To classify the various methods of ground improvement techniques to increase load bearing capacity of beneath and surface soils. (L4)

UNIT – II (9 Hrs)

Densification Methods In Cohesive Soils:– In – situ densification methods in Cohesive soils:– Preloading or dewatering, Vertical drains – Sand Drains, Sand wick geodrains – Stone and lime columns – thermal methods.

Densification Methods In Granular Soils:- Deep compaction techniques, blasting, vibro compaction, dynamic tamping and compaction piles

Learning Outcomes: At the end of this unit, students should be able to

- Understand methods of in-situ densification (L2)
- Develop different types of drains for soil densification. (L6)

UNIT – III (9 Hrs)

Stabilization: Methods of stabilization-mechanical-cement- Lime-bituminous-Chemical stabilization with calcium chloride, sodium silicate and gypsum

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance stabilization mechanical & chemical methods (L2)
- Develop different methods of stabilization of soils (L6)

UNIT – IV (9 Hrs)

Geosynthetics: Geotextiles- Types, Functions and applications – Geogrids and geomembranes – Functions and applications.

Reinforced Earth: Reinforce earth – principles – components of reinforced earth – design principles of reinforced earth walls – stability checks – soil nailing

Learning Outcomes: At the end of this unit, students should be able to

- Manage principles of reinforced earth in ground improvement (L6)
- Explain the various Applications of geotextiles in various civil engineering projects. (L4)
- Choose the advanced materials for ground improvement(L5)

UNIT – V (9 Hrs)

Expansive Soils: Problems of expansive soils – Tests for identification – Methods of determination of swell pressure. Improvement of expansive soils – Foundation techniques in expansive soils – Under reamed piles.

Learning Outcomes: At the end of this unit, students should be able to

- To analyze the problematic soils and its characteristics to select the suitable method for ground improvement. (L4)
- To analyze the expansive soil properties and apply the same for the design of structures on expansive soils (L4)

TEXTBOOKS:

1. “Engineering Principles of Ground Modification”, M.R. Haussmann, McGraw Hill Indian Edition, 2013.
2. “Ground Improvement Techniques”, Dr. P. Purushotham Raj, Laxmi Publications, New Delhi University science press, 2nd Edition, 2016
3. “Ground Improvement Techniques”, Nihar Ranajan Patra, Vikas Publications, New Delhi, 2012.

REFERENCE BOOKS:

1. “Ground Improvement”, M.P. Moseley, Blackie Academic and Professional, Boca Taton, Florida, USA, 2nd Edition, 2004.
2. “Ground Control and Improvement”, P. P. Xanthakos, L.W. Abramson and D.A. Brucwe, John Wiley and Sons, New York, USA, 1994
3. “Designing with Geosynthetics”, Robert M. Koerner, Prentice Hall New Jersey, USA, 6th Edition, 2012.

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/105104034/
2. http://www.myopencourses.com/subject/ground-improvement-techniques
3. https://nptel.ac.in/courses/105108075

Course Code	ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT		L	T	P	C
21A010434			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To impart knowledge on different concepts of Environmental Impact Assessment
- To teach procedures of risk assessment.
- To teach the EIA methodologies and the criterion for selection of EIA methods.
- To teach the procedures for environmental clearances and audit.
- To know the impact quantification of various projects on the environment.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Classify the environmental parameters by using various EIA methods. **(K2)**
CO2: Analyze the risks and impacts of a project **(K4)**
CO3: Discriminate the Impact of development Activities on Vegetation ,wildlife **(K4)**
CO4: Evaluate the Audit data and prepare the Audit report. **(K5)**
CO5: Illustrate the different types of environmental acts. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	2	2	-	-	2	-	2	-
CO2	2	3	3	3	-	-	2	1	-	-	2	-	2	-
CO3	3	3	3	3	-	-	2	2	-	-	2	-	2	-
CO4	3	3	2	3	-	-	2	1	-	-	2	-	2	-
CO5	3	3	2	3	-	-	2	2	-	-	2	-	2	-

UNIT – I (9 Hrs)

Introduction: Concepts and methodologies of EIA Initial environmental Examination, Elements of EIA, - factors affecting EIA Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters- Criteria for the selection of EIA Methodology, EIA methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze and evaluate the factors affecting elements of EIA. (L4)
- Choose the criteria for selection of EIA methodology (L5)

UNIT – II (9 Hrs)

Impact of Developmental Activities and Land Use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives.

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact

Learning Outcomes: At the end of this unit, students should be able to

- Compute the factors causing impact of development activities (L3)
- Decide mitigation measures of pollution on environment (L3)

UNIT – III (9 Hrs)

Assessment of Impact on Vegetation, Wildlife and Risk Assessment: Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation - Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment- Advantages of Environmental Risk Assessment

Learning Outcomes: At the end of this unit, students should be able to

- Express the effect of development activities on environment. (L6)
- Explain the advantages of Environmental Risk Assessment (L4)

UNIT – IV (9 Hrs)

Environmental Audit: Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report

Learning Outcomes: At the end of this unit, students should be able to

- Choose about the process of environmental auditing (L5)
- Illustrate the procedures for preparation of environmental audit report (L2)

UNIT – V (9 Hrs)

Environmental Acts and Notifications: The Environmental protection Act, The water preservation Act, The Air (Prevention & Control of pollution Act), Wild life Act - Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- Evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000.

Learning Outcomes: At the end of this unit, students should be able to

- Explain importance of environmental protection acts (L4)
- Choose acts and notifications in Environmental legislation (L5)

TEXTBOOKS:

1. "Environmental Impact Assessment", W. Canter Larry, McGraw-Hill education, 2nd Edition, 1996
2. "Environmental Impact Assessment Methodologies", Y. Anjaneyulu, B.S. Publication, Hyderabad, 3rd Edition, 2020

ONLINE LEARNING RESOURCES:

1. http://environmentclearance.nic.in/
2. http://www.fao.org/docrep/v8350e/v8350e0d.htm
3. http://elaw.org/system/files/tor-eia.pdf

Course Code	ADVANCED R.C.C STRUCTURAL DESIGN		L	T	P	C
21A010435			3	0	0	3
Pre-requisite	Design of Reinforced Concrete Structures	Semester	VII			

COURSE OBJECTIVES:

- To design and detailing of reinforcement of an interior panel of a flat slab
- To design a circular bunker with the detailing of reinforcement
- To design a concrete chimney with detailing of reinforcement.
- To design different elements of the circular and rectangular shape water tanks.
- To design and detailing of the reinforcement in the various members of the cantilever and counter fort retaining walls.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design and detail the flat slabs **(K6)**
CO2: Design and detail bunkers and silos **(K6)**
CO3: Design and detail concrete chimney **(K6)**
CO4: Design and detail water tanks resting on the ground **(K6)**
CO5: Design and detail cantilever and counterfort retaining walls **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO4	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO5	2	2	2	2	-	-	-	-	-	-	-	2	2	2

UNIT – I (9 Hrs)

Design of a flat slab (Interior panel only).

Learning Outcomes: At the end of this unit, students should be able to

- Design and detailing of reinforcement of interior panel of the flat slab (L6)

UNIT – II (9 Hrs)

Design of concrete bunkers of circular shape – (excluding staging) – Introduction to silos

Learning Outcomes: At the end of this unit, students should be able to

- Design and detailing of reinforcement of bunker (L6)

UNIT – III (9 Hrs)

Design of concrete chimney (excluding seismic loads)

Learning Outcomes: At the end of this unit, students should be able to

- Design the concrete chimney. (L6)

UNIT – IV (9 Hrs)

Design of circular and rectangular water tank resting on the ground

Learning Outcomes:

At the end of this unit, students should be able to

- Design Circular and rectangular water tanks resting on the ground. (L6)

UNIT V (9 Hrs)

Design of cantilever and counter forte retaining wall with horizontal back fill only.

Learning Outcomes:

At the end of this unit, students should be able to

- Design and detailing of the cantilever and counter forte retaining walls(L6)

Note: Relevant IS Codes are to be permitted in the examination hall

FINAL EXAMINATION PATTERN:

The question paper shall consist of two questions of either or type covering the entire syllabus. Where each question carries 35 marks. Out of 35 marks, 20 marks shall be for the design and 15 marks are for the Drawing.

TEXTBOOKS:-

1. “Structural Design and drawing (RCC and steel)”, Krishnam Raju, Universities Press, New Delhi, 3rd Edition, 2009.
2. “R.C.C Structures”, Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications,New Delhi, 2015
3. “Advanced RCC”, Varghese, PHI Publications, New Delhi.
4. “Design of RCC structures”, M. L. Gambhir, P.H.I. Publications, New Delhi, 2008.

REFERENCE BOOKS:-

1. “R.C.C Designs standard”, Sushil kumar, Publishing house, 2016.
2. “Fundamentals of RCC”, N. C. Sinha and S. K. Roy, S. Chand Publications, New Delhi, Kindle Edition, 2007.

ONLINE LEARNING RESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105105/
2. https://nptel.ac.in/courses/105105104

Course Code	ADVANCED FOUNDATION ENGINEERING		L	T	P	C
21A010436			3	0	0	3
Pre-requisite	Foundation Engineering	Semester	VII			

COURSE OBJECTIVES:

- To understand how Meyerhof's general bearing capacity equations are important over Terzaghi's bearing capacity equation.
- To teach special methods of computation of settlements, corrections to be applied and the advanced concepts of design of pile foundations.
- To throw light on pile and mat foundation designs.
- To understand the design of earth retaining structures.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the safe bearing capacity of footings subjected to vertical and inclined loads. **(K3)**

CO2: Compute the advanced methods of settlement computations and proportion foundation of footings. Using different methods **(K3)**

CO3: Differentiate between isolated, combined and mat foundations. **(K4)**

CO4: Analyze the function of different components of earth retaining structures and their stability. **(K4)**

CO5: Compute the pull-out capacity and negative skin friction of piles and the settlement of pile groups in clay **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	-	-	-	-	-	-	-	2	2	2
CO2	2	3	2	2	-	-	-	-	-	-	-	2	2	2
CO3	2	3	2	2	-	-	-	-	-	-	-	2	2	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2	2	2
CO5	2	3	2	2	-	-	-	-	-	-	-	2	2	2

UNIT – I (9 Hrs)

Bearing Capacity of Foundations: Bearing capacity of Foundations using general bearing capacity equation – Meyerhof's, Brinch Hansen's and Vesic's methods- Bearing capacity of Layered Soils: Strong layer over weak layer, Weak layer on strong layer – Bearing capacity of foundations on a top of slope – Bearing capacity of foundations at the edge of the slope.

Learning Outcomes: At the end of this unit, students should be able to

- Explain bearing capacity of different types of soil (L3)
- Determine the bearing capacity of soils using different techniques.(L3)

UNIT – II (9 Hrs)

Settlement Analysis: Immediate settlement of footings resting on granular soils – Schmertmann & Hartman method– De Beer and Martens method - Immediate settlement in clays – Janbu's method – correction for consolidation settlement using Skempton and Bjerrum's method – Correction for construction period.

Learning Outcomes: At the end of this unit student will be able to

- Analyze the settlement of footing by various methods. (L4)
- Determine corrections for construction period(L3)

UNIT – III (9 Hrs)

Mat Foundations: purpose and types of isolated and combined footings – Mats/ Rafts – Proportioning of footings – Ultimate bearing capacity of mat foundations – allowable bearing capacity of mats founded in clays and granular soils – compensated rafts- annular foundations.

Learning Outcomes: At the end of this unit student will be able to

- Identify various types of footings (L2)
- Determine ultimate &allowable bearing capacity of mat foundation(L6)

UNIT – IV (9 Hrs)

Earth-Retaining Structures – cantilever sheet piles – anchored bulkheads – fixed and free earth support methods – design of anchors – braced excavations – function of different components – forces in ties – Basal heaving stability against bottom heave

Learning Outcomes: At the end of this unit student will be able to

- Express the need and importance of earth retaining structures (L6)
- Design of earth retaining structures according to stability concepts.(L6)

UNIT -V (9 Hrs)

Pile Foundation: Pile foundations – single pile versus group of piles – load-carrying capacity of pile groups – negative skin friction (NSF) -settlement of pile groups in sands and clays – laterally loaded piles in granular soils – Reese and Matlock method – laterally loaded piles in cohesive soils – Davisson and Gill method – Broms' analysis.

Learning Outcomes: At the end of this unit student will be able to

- Analyze conditions for adopting pile foundations (L6)
- Assess the load carrying capacity of piles and pile groups in different types of soils. (L4)

TEXTBOOKS:

1. "Foundation Analysis and Design", J. E. Bowles, John Wiley, 5th Edition, 2001.
2. "Soil Mechanics and Foundation Engineering", Arora, Standard Publishers and

Distributors, Delhi, 2020

3. “Soil Mechanics and Foundation Engineering”, V. N. S. Murthy, CBS Publisher, 2018

REFERENCE BOOKS:

1. “Foundation Design”, W.C. Teng, Prentice Hall Publishers, 1962.
2. “Geotechnical Engineering”, C. Venkataramiah, New age International Pvt . Ltd, 6th Edition, 2018.
3. “Foundation Analysis and Design”, J.E. Bowles, McGraw-Hill Publishing Company, New york, 4th Edition, 2001
4. “Pile Foundation Analysis and Design”, H. G. Poulos and E. H. Davis, John Wiley, 1st Edition, 1980.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105105207
2. https://nptel.ac.in/courses/105105039

Course Code	PRESTRESSED CONCRETE		L	T	P	C
21A010437			3	0	0	3
Pre-requisite	Strength of Materials	Semester	VII			

COURSE OBJECTIVES:

- To analyze PSC beams with straight, concentric, eccentric, bent and parabolic tendons and design beams of rectangular and I section for flexure.
- To impart knowledge on Design shears reinforcements, structural elements for shear, torsion and anchorage as per the provisions of BIS.
- To understand the transmission mechanism of pre-stressing force by bond and compute deflection of beams under loads

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the concepts of Principal and methods of pre stressing. **(K2)**
CO2: Compute losses of pre-stress in pre-stressed concrete members. **(K3)**
CO2: Analyze and Design PSC beams under flexure and shear. **(K4)**
CO4: Estimate the short- and long-term deflections of PSC beams. **(K4)**
CO5: Apply prestressing concepts for composite beams **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	-	2	-	-	-	-	-	2	2
CO2	2	2	2	2	-	-	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

Introduction: Principles of pre-stressing – pre stressing systems - pre-tensioning and post tensioning- Advantages and limitations of Pre stressed concrete- need for high strength materials. Methods of pre-stressing: Pre-tensioning (Hoyer system) and Post-tensioning methods (Freyssinet system and Gifford- Udall System).

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate pre tensioning and post tensioning (L4)
- Illustrate different type of prestressing systems. (L3)

UNIT – II (9 Hrs)

Losses of Pre-Stress: Loss of pre-stress in pre-tensioned and post-tensioned members due to elastic shortening, shrinkage and creep of concrete, relaxation of stress in steel, anchorage slip and frictional losses.

Learning Outcomes: At the end of this unit, students should be able to

- Classify different types of losses in prestressing (L2)
- Estimate losses of pre stress due to shrinkage, creep, slip etc (L4)

UNIT – III (9 Hrs)

Flexure and Shear: Analysis of beams for flexure and shear - beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons- Kern line - Cable profile - design of PSC beams (rectangular and I sections) using IS 1242. Analysis and design of rectangular and I beams for shear. Introduction to Transmission length and End block (no Design and Analytical problems).

Learning Outcomes: At the end of this unit, students should be able to

- Analyze beams for flexure and shear (L4)
- Express prestressing with different types of tendons on beams of varying shape (L6)
- Determine end block characteristics and its significance (L3)

UNIT – IV (9 Hrs)

Deflections: Control of deflections- Factors influencing deflections - short term deflections of un cracked beams- prediction of long-time deflections.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between short term and long-term deflections in PSC beams (L4)
- Estimate the short- and long-term deflections of PSC beam. (L4)

UNIT – V (9 Hrs)

Composite Beams: Different Types- Propped and Un-propped- stress distribution- Differential shrinkage- Analysis of composite beams.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate different types of composite beams (L4)
- Analyze PSC composite beams. (L4)

TEXTBOOKS:

1. "Prestressed Concrete", N. Krishna Raju, Tata McGraw Hill Publications, 6th Edition, 2018.
2. "Prestressed Concrete Design", Praveen Nagrajan, Pearson publications, 2013.
3. "Prestressed Concrete", K. U. Muthu, PHI Learning Pvt. Ltd., Delhi, 2016.

REFERENCE BOOKS:

1. "Design of Prestressed Concrete Structures", T.Y. Lin & Ned H. Burns, John Wiley & Sons, 3rd Edition, 2011.

2. "Prestressed Concrete", Ramamrutham, Dhanpatrai Publications, 2003.
3. "Prestressed concrete", Rajagopalan, Narosa Publishing House, 2nd Edition, 2005.

Note: BIS code on "prestressed concrete", IS: 1343:2012 to be permitted into examination hall.

ONLINE LEARNING RESOURCES:

1. https://archive.nptel.ac.in/courses/105/106/105106118/
2. https://nptel.ac.in/courses/105106117
3. https://www.digimat.in/nptel/courses/video/105106118/L01.html

Course Code	MANAGEMENT SCIENCE		L	T	P	C
21A110204	(Common to all Branches)		3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training& Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Apply the concepts and principles of management in real life industry design and develop organization chart and structure for an enterprise. **(K3)**

CO2: Apply operations management techniques in real life industry. **(K3)**

CO3: Apply the concepts of HRM in Recruitment, Selection, Training & Development. **(K3)**

CO4: Develop PERT/CPM charts for projects of an enterprise and estimate time & cost of a project and to develop Mission, Objectives, Goals & Strategies for an enterprise in dynamic environment. **(K3)**

CO5: Understand & apply modern management techniques wherever possible. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	3	-	-	-

UNIT – I (9 Hrs)

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of management and organization (L2)

- Apply the concepts & principles of management in real life industry (L3)
- Analyze the organization chart & structure for an enterprise.(L4)
- Evaluate and interpret the theories and the modern organization theory (L5)

UNIT – II (10 Hrs)

Operations Management: Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the core concepts of Management Science and Operations Management (L2)
- Apply the knowledge of Quality Control, Work-study principles in real life industry (L3)
- Evaluate Materials departments & Determine EOQ (L5)
- Analyze Marketing Mix Strategies for an enterprise (L4)
- Create and design advertising and sales promotion (L5)

UNIT – III (6 Hrs)

HUMAN RESOURCES MANAGEMENT: HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development (L2)
- Apply Managerial and Operative Functions (L3)
- Analyze the need of training (L4)
- Evaluate performance appraisal (L5)
- Design the basic structure of salaries and wages (L5)

UNIT – IV (12 Hrs)

Strategic & Project Management: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme

Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

Learning Outcomes: At the end of this unit, students should be able to

- Understand Mission, Objectives, Goals & Strategies for an enterprise (L2)
- Apply SWOT Analysis to strengthen the project (L3)
- Analyze Strategy formulation and implementation (L4)
- Evaluate PERT and CPM Techniques (L5)
- Create in competing the projects within given time (L5)

UNIT – V (8 Hrs)

Contemporary Issues in Management: The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand modern management techniques (L2)
- Apply Knowledge in modern management (L3)
- Analyze CRM, TQM (L4)
- Evaluate Six Sigma concept and SCM (L5)

TEXTBOOKS:

1. "Management Science", A.R Aryasri, TMH, 2013
2. "Management", Stoner, Freeman, Gilbert, Pearson Education, New Delhi, 2012.

REFERENCE BOOKS:

1. "Essentials of Management", Koontz &Weihrich, TMH, 6th Edition, 2005.
2. "Management Principles and Guidelines", Thomas N. Duening & John M. Ivancevich, Biztantra.
3. "Production and Operations Management", Kanishka Bedi, Oxford University Press, 2004.
4. "Modern Management", Samuel C. Certo, 9th Edition, PHI, 2005

Course Code	PROJECT MANAGEMENT LAB		L	T	P	C
21A030704			1	0	2	2
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand about Project management and Primavera software
- To impart on enterprise environment in primavera
- To teach the students about the WBS activities and basic formatting
- To impart on Planning and creating new projects
- To teach monitoring and control of project

COURSE OUTCOMES

After completion of the course, the student will be able to

CO1: Categorize with the basic concepts of Project management and Primavera software **(K4)**
CO2: Choose Enterprise environment in primavera **(K4)**
CO3: Explain the activities, estimating and adding duration of activities **(K4)**
CO4: Practice and Create new project in primavera **(K3)**
CO5: Choose and manage the resources and expenditure **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	-	2	-	-	-	-	-	2		3	3
CO2	1	1	1	-	2	-	-	-	-	-	2		3	3
CO3	1	1	1	-	2	-	-	-	-	-	2		3	3
CO4	1	1	1	-	2	-	-	-	-	-	2		3	3
CO5	1	1	1	-	2	-	-	-	-	-	2		3	3

UNIT – I (9 Hrs)

Basic Concepts and Introduction to Primavera: Definition of project, basics of project management, schedule and its importance, Critical path method for scheduling, understanding Gantt charts, introduction to Primavera software

Learning Outcomes: At the end of this unit, students should be able to

- Choose the basics of project management, schedules and its importance (L5)
- Asses the importance of Critical path method for scheduling(L5)
- Visualize importance of Gantt charts (L4)

UNIT – II (9Hrs)

ENTERPRISE ENVIRONMENT IN PRIMAVERA: Organizational breakdown structure (OBS) , Enterprise project structure (EPS), work breakdown structure (WBS)

Learning Outcomes: At the end of this unit, students should be able to

- Choose the various structures like OBS, EPS & WBS(L5)
- Express importance of OBS, EPS & WBS(L6)

UNIT – III (9 Hrs)

WBS Activities and Basic Formatting: Creating WBS in Primavera, Formatting columns and time scale, percentage complete types, Activity types, activity constraints, setting activities, estimating and adding duration of activities, understanding relationships, scheduling algorithm

Learning Outcomes: At the end of this unit, students should be able to

- Express importance of activities(L6)
- Design the activities for various works (L6)

UNIT – IV (9 Hrs)

Calendars, Planning And Creating New Projects: Define calendars, role of calendars in scheduling, adding and assigning calendars. Planning project schedule, understanding sample project, creating new project in primavera, total float and project finish date.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the schedules and project finish date. (L4)
- Formulate the Plan and create new projects in primavera (L6)

UNIT – V (9 Hrs)

Formatting, Sharing Reporting, Maintaining, Role and Resources: Formatting bars, groups, sort and lay outs , updating a project, monitoring and controlling. Understanding roles, resources and expenditure. Adding roles, resources, resource options, renewing resource and cost usage, updating a project with resources and expenses**,** Earned value analysis, Thresholds, issues and risk management

Learning Outcomes: At the end of this unit, students should be able to

- Manage the Monitor and control the project. (L6)
- Manage the Plan the resource and cost usage(L6)
- Expresses the overcome the issues related to risk management (L6)

LIST OF EXPERIMENTS:

1. Introduction to Primavera P6 core concepts
2. Navigating and customizing the workspace
3. Creating project through Wizard &details- updating project information
4. Modifying & assigning the project
5. Creating Activities using wizards &details

6. Creating Resources using Wizards & details
7. Calculating cost of activities
8. Project resources Analysis, Activity Analysis
9. Updating and maintaining the project
10. Monitoring and Controlling Project schedule
11. Project performance Monitoring
12. Project reports Printing

TEXTBOOKS:

1. "Planning and managing projects with Primavera (P6) project planner", P Vinayagam and A Vimala, I K International Publishing House Pvt. Ltd, 1st Edition, February 2017
2. "Planning and Control Using Oracle Primavera P6", Paul E Harris, Eastwood Harris Pty Ltd, Jan 2021

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/105106149

OPEN ELECTIVE – I

Course Code	ELECTRIC VEHICLES		L	T	P	C
21A020501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- Get exposed to EV system configuration and parameters
- Know about electro mobility and environmental issues of EVs
- Understand about basic EV propulsion and dynamics
- Understand about fuel cell technologies for EV and HEVs
- Know about basic battery charging and control strategies used in electric vehicles

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand and differentiate between conventional and latest trends in Electric vehicles. **(K2)**

CO2: Analyze various EV resources, EV dynamics and Battery charging. **(K4)**

CO3: Apply basic concepts of EV to design complete EV system. **(K3)**

CO4: Design EV system with various fundamental concepts. **(K5)**

CO5: Analyze the various control strategies used in battery charging in the electric vehicles. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to EV Systems and Parameters: Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic concepts of EV to design complete EV system. (L3)
- Explain EV system configuration. (L3)
- Understand various EV parameters. (L2)

UNIT – II (9 Hrs)

EV and Energy Sources: Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand electro mobility and environmental issues of EVs. (L2)
- Explain the history of Electric power trains. (L3)
- Compare conventional, battery, hybrid and fuel cell electric systems. (L3)

UNIT – III (9 Hrs)

EV Propulsion and Dynamics: Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi-motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of EV system. (L2)
- Choose a suitable electric propulsion system. (L2)
- Classify EV motors and their applications. (L3)

UNIT – IV (9 Hrs)

Fuel Cells: Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples.

Learning Outcomes: At the end of this unit, students should be able to

- FUEL CELLS: Explain the working principle of Fuel cells. (L3)
- Analyze fuel cell technologies for EV and HEVs. (L4)
- Compare series, series-parallel hybrid systems. (L3)

UNIT – V (9 Hrs)

Battery Charging and Control: Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modeling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic battery charging in Electric Vehicles. (L2)

- Analyze control strategies used in electric vehicles. (L4)

TEXTBOOKS:

1. "Modern Electric Vehicle Technology", C.C Chan, K.T Chau, Oxford University Press Inc., New York 2001.
2. "Electric Vehicle Technology Explained", James Larmenier, John Lowry, Wiley, 2003.

REFERENCE BOOKS:

1. "Electric and Hybrid Vehicles Design Fundamentals", Iqbal Husain, CRC Press 2005.
2. "Advanced Electric Drive Vehicles", Ali Emadi, CRC Press, 2015.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

Course Code	ELECTRICAL DISTRIBUTION SYSTEMS		L	T	P	C
21A020502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- The classification of distribution systems
- The aspects and design considerations in DC and AC distribution and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Compute the various factors associated with power distribution. **(K3)**
CO2: Make voltage drop calculations in given distribution networks. **(K3)**
CO3: Learn principles of substation maintenance. **(K2)**
CO4: Compute power factor improvement for a given system and load. **(K3)**
CO5: Understand implementation of SCADA for distribution automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Load Modeling and Characteristics: Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural, and Industrial) and Their Characteristics.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic concepts of the electrical distribution systems. (L2)
- Analyze the relationship between load factor and loss factor. (L4)
- Understand the various loads and its characteristics. (L2)

UNIT – II (9 Hrs)

Classification Of Distribution Systems: Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the classification of electrical distribution systems. (L2)
- Analyze the design considerations of the radial and loop type feeders. (L4)

UNIT – III (9 Hrs)

Substations: Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar Sectionalized Single Bus Bar, With Relevant Diagrams.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the layout of the substation and various equipment installed. (L2)
- Analyze the classification of the substation based on insulating medium. (L4)
- Understand various bus bar schemes in substation. (L2)

UNIT – IV (9 Hrs)

Power Factor Improvement: Three Phase Balanced Primary Lines. Causes of Low P.F -Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

UNIT – V (9 Hrs)

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer

Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

TEXTBOOKS:

1. "Electric Power Distribution Engineering", Turan Gonen, CRC Press, 3rd Edition, 2014.
2. "Electric Power Distribution", A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

REFERENCE BOOKS:

1. "Electric Power Distribution Automation", Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010
2. "Electrical Power Distribution Systems", V. Kamaraju, Jain Book Depot, 2012.

Course Code	ROBOTICS		L	T	P	C
21A030501			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control
- To choose and incorporate robotic technology in engineering systems.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand the introduction and types of robots. **(K2)**

CO2: Analyze kinematics using forward and inverse kinematics and dynamics of robots using transformation, Jacobians, Lagrange – Euler and Newton – Euler formation. **(K4)**

CO3: Understand the working principle of different types of actuators and sensors. **(K2)**

CO4: Understand the motion types and robot programming software. **(K2)**

CO5: Know importance of robotic Applications in manufacturing. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	1	-	-	-	-	-	-	2	3	-
CO2	1	-	3	-	-	-	-	-	-	-	-	1	1	3
CO3	3	-	2	-	2	-	-	-	-	-	-	1	3	1
CO4	3	-	2	-	3	-	-	-	-	2	-	-	3	2
CO5	3	-	2	-	2	-	-	-	-	1	-	2	3	-

UNIT – I (8 Hrs)

Introduction to Industrial Robots: Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of robots. (L2)
- Differentiate types of robots and robot grippers. (L4)

UNIT – II (8 Hrs)

Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation-D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformation, Jacobians .Lagrange – Euler and Newton – Euler formations.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire the knowledge about robot kinematics and dynamics. (L2)
- Analyze the forward and inverse kinematics of robot manipulators. (L4)

UNIT – III (9 Hrs)

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile sensors, Proximity sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the various types of robot actuators and feedback components. (L1)
- Understand the working of robot sensors. (L2)

UNIT – IV (11 Hrs)

Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion.

Robot programming - Types – features of languages and software packages.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze motion in links and joints of a robot. (L4)
- Understand the types and software packages of robots. (L2)

UNIT – V (9 Hrs)

Robot Application in Manufacturing: Material Transfer -Material handling, loading and unloading - Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Learning Outcomes: At the end of this unit, students should be able to

- Express the various applications of robots in industries. (L2)
- Acquire the knowledge about real time applications of robots in manufacturing. (L2)

TEXTBOOKS:

1. “Industrial Robotics”, M.P. Groover, TMH.
2. “Robotics, Fundamental Concepts and analysis”, Ashitave Ghosal, Oxford Press
3. “Robotics and Control”, Mittal R K & Nagrath I J, TMH.

REFERENCE BOOKS:

1. “Robotics”, Fu K S, McGraw Hill.
2. “An Introduction to Robot Technology”, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.

3. "Robotic Engineering", Richard D. Klafter, Prentice Hall
4. "Introduction to Robotics", John J. Craig, Pearson Edu
5. "Automation, Production systems and CIM", M.P. Groover, Pearson Edu

Course Code	BASICS OF MECHANICAL ENGINEERING		L	T	P	C
21A030502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize students with basic power plants types, turbines, pumps, IC engines, boilers, refrigeration and air conditioning process and their performance aspects.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Know types of power generating plants by using conventional or Non-conventional resources. **(K2)**

CO2: Understand and implementation of turbines, explain different types of pumps and their application. **(K2)**

CO3: Describe To familiarize the developments in IC engines. **(K2)**

CO4: Uunderstand the concept of the boilers. **(K2)**

CO5: Explain the working principles of refrigeration and air conditioning systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	2	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-	-	2	-	-

UNIT – I (10 Hrs)

Power Plant Engineering: Introduction – Energy Renewable and Non – Renewable Energy, Sources – Classification of Power Plants based on Sources of Energy – Thermal Power Plant or Steam Power Plant – Hydro Electric Power – Nuclear Fission, Chain Reaction, Layout of Nuclear Power Plant – Diesel Power Plant – Gas Turbine Power Plant – Open Cycle Gas Turbine, Closed Cycle Gas Turbine Power Plant, Comparison of Diesel Power Plant with Gas Turbine Power Plant.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the energy Renewable and Non – Renewable Energy Sources. (L2)
- Illustrate the working principle of Steam, Nuclear & open cycle, and closed cycle gas turbine. (L2)

UNIT – II (10 Hrs)

Hydraulic Turbine – Classification of Hydraulic Turbines, Impulse Turbine, Reaction Turbine, Difference between Impulse and Reaction Turbine.

Pumps – Classification of Pumps, Centrifugal Pump, Applications of Centrifugal Pump, Priming, Reciprocating Pumps, Single Acting Reciprocating Pump, Working of a Double acting Reciprocating Pump, Comparison of Reciprocating Pump with Centrifugal Pump.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Hydraulic Turbines, Impulse Turbine, and Reaction Turbine. (L2)
- Understand the working of Centrifugal Pump, Reciprocating Pumps and Comparison between them. (L2)

UNIT – III (10 Hrs)

I.C Engine: Heat Engine – Types of Heat Engine – External Combustion Engine, IC Engine (Internal Combustion), Classification of I.C. Engine, Two Stroke Petrol Engine, Four Stroke Engine, Valve Timing Diagram, Port Timing Diagram, Comparison of Two Stroke and Four Stroke Engines, Comparison of Petrol Engine and Diesel Engine, Fuel System of a Petrol Engine, Ignition Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of External Combustion Engine, IC Engine. (L2)
- Illustrate the working of Two Stroke Petrol Engine, Four Stroke Engine. (L2)

UNIT – IV (7 Hrs)

Boilers: Classification of Boilers – Simple Vertical Boiler – Cochran Boiler – Babcock and Wilcox Boiler – Benson Boiler – Difference between Fire Tube and Water Tube Boilers – Boiler Mountings – Boiler Accessories – Difference between Boiler Mountings and Accessories.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of different types Fire Tube and Water Tube Boilers.(L2)

UNIT – V (8 Hrs)

Refrigeration and Air Conditioning: Introduction – Terminology of Refrigeration and Air Conditioning – Properties of Refrigerants – List of Commonly used Refrigerants – Types of Refrigerating System – Vapour Compression Refrigeration System – Vapour Absorption Refrigerator – Domestic Refrigerator – Air Conditioning – Application of Air Conditioning – Psychrometry – Window Air Conditioning.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Vapour Compression Refrigeration System – Vapour Absorption Refrigeration system. (L2)
- Illustrate the working of Air Conditioning. (L2)

TEXTBOOKS:

1. "Basic Civil and Mechanical Engineering", Er. R. Vaishnavi, Prof. V. Vijayan, Prof. M. Prabhakaran, S. Chand Publication, 2nd Edition
2. "Elements of Mechanical Engineering", S Trymbaka Murthy, University Press, 4th Edition

REFERENCE BOOKS:

1. "Elements of Mechanical Engineering", S. N. Lal, Cengage Learning, 2013
2. "Elements of Mechanical Engineering", S. Trymbaka Murthy, Universities Press, 2015
3. "Mechanical Technology", Dr M. Maruthi Rao and V. Pavan Kumar, Lambert Academic Publishing, 2022

Course Code	INTEGRATED CIRCUITS AND APPLICATIONS		L	T	P	C
21A040501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To introduce the basic building blocks of linear integrated circuits.
- To impart knowledge on linear and non-linear applications of Op-Amps.
- To design various circuits using Op-Amps.
- To familiarize with specialized ICs such as 555 timer and voltage regulators.
- To familiarize with digital ICs.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the construction and characteristics of Operational Amplifier IC **(K2)**
CO2: Explain various linear & non-linear applications of Op-amp **(K2)**
CO3: Develop knowledge on filters and describe internal circuit operation of 555 timer and voltage regulators ICs **(K3)**
CO4: Summarize combinational circuits using Digital integrated circuits **(K3)**
CO5: Explain the internal structure of sequential Digital integrated circuits **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	3	1	-
CO2	2	2	2	1	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	1	-	-	-	-	-	-	-	3	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	1	-

UNIT – I (8 Hrs)

INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER: Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of IC & classifications (L2)
- Understand the concepts of Operational amplifier. (L2)
- Illustrate the internal circuit of operational amplifier (L2)
- Analyze DC & AC characteristics of op-amp (L4)

UNIT – II (10 Hrs)

LINEAR APPLICATIONS OF OP-AMP: Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveformgenerators, Oscillators

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of integrator & differentiator circuits (L2)
- Understand the concepts of multivibrators and waveform generators (L2)
- Develop the output voltage expression for instrumentation amplifier (L3)
- Analyze the adder, subtractors, multiplier and divider circuits (L4)

UNIT – III (10 Hrs)

ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

TIMERS AND REGULATORS: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, Introduction-Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on 1st and 2nd order active filters. (L3)
- Understand the functionality of 555 timer. (L2)
- Understand the internal structure and functionality of voltage regulators (L2)

UNIT – IV (8 Hrs)

COMBINATIONAL CIRCUITS USING TTL 74XX ICS: Study of logic gates using 74XX ICs,Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7- segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on the working of various combinational circuit ICs. (L3)
- Develop higher order combinational circuits from lower order Combinational ICs. (L3)

UNIT – V (9 Hrs)

SEQUENTIAL CIRCUITS USING TTL 74XX ICS: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493), Memory -SRAM & DRAM.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of sequential circuits using TTL ICs. (L2)
- Develop higher order Sequential circuits from lower order Sequential ICs. (L3)

TEXTBOOKS:

1. "Linear Integrated Circuit", D. Roy Choudhury, Shail B. Jain, New AgeInternational Pvt.Ltd., New Delhi, India, 4^{th} Edition, 2012
2. "OP-AMP and Linear Integrated Circuits", Ramakant A. Gayakwad, Prentice Hall / Pearson Education, New Delhi, 4^{th} Edition, 2012
3. "Digital Fundamentals", Floyd, Jain, Pearson Education, New Delhi, 8^{th} Edition, 2009.

REFERENCE BOOKS:

1. "Design with operational amplifiers and analog integrated circuits", Sergio Franco McGrawHill, New Delhi, 1997
2. "Digital Design Principles and Practices", John F Wakerly, Pearson Education, 4^{th} Edition

Course Code	INTRODUCTION TO SIGNAL PROCESSING		L	T	P	C
21A040502			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- To represent continuous time signals (both periodic and non-periodic) in the time domain, s-domain and the frequency domain.
- To understand the properties of analog filters, and have the ability to design Butterworth filters.
- To understand and apply sampling theorem and convert a signal from continuous time to discrete time and able to represent the discrete time signal in the frequency domain.
- To understand FIR and IIR filters to meet given specifications.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain continuous time and discrete time signals and systems, in time and frequency domain. **(K3)**

CO2: Apply Fourier series and Fourier Transform to analyze periodic & non-periodic signals and their spectra. **(K3)**

CO3: Design and implement the analog filter using components/suitable simulation tools. **(K4)**

CO4: Apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time. **(K3)**

CO5: Design and implement the digital filter using suitable simulation tools. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3		-	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	3	3		-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction to Signals & Systems: Signal Definition, Signal Classification, System definition, System classification for both continuous time and discrete time, Basic Operations on Signals, Elementary Signals & Sequences, Definition of LTI systems, Transfer function of a LTI system, Concepts of Convolution and Correlation of signals, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different basic types of signals and systems. (L2)
- Understand various basic operations on signals and elementary signals. (L2)
- Describe continuous time signal and discrete time signal. (L2)
- Sketch the various types of basic signals for both continuous time & discrete time. (L3)
- Understand the LTI systems, convolution & correlation of signals. (L2)

UNIT – II (10 Hrs)

Fourier Series & Transform: Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems, Fourier Transform of arbitrary signal, Properties of Fourier Transform, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the periodic signals by applying Fourier series. (L4)
- Apply Fourier transform to solve problems. (L3)
- Analyze the spectral characteristics of signals. (L4)

UNIT – III (8 Hrs)

Analog Filters: Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of analog filters. (L2)
- Design and implement the analog Butterworth filters. (L4)

UNIT – IV (8Hrs)

Sampling Theorem & DFT: Sampling Theorem- Statement and proof, converting the analog signal to a digital signal, Practical sampling, The Discrete Fourier Transform, Properties of DFT, IDFT, Comparing the frequency response of analog and digital systems, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of sampling techniques. (L2)
- Illustrate signal sampling and its reconstruction. (L3)
- Explain the importance of discrete Fourier transform. (L3)

UNIT – V (10Hrs)

Digital Filters: Characteristics of FIR and IIR filters. Frequency response of ideal digital filters, Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, Comparison of FIR & IIR, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of IIR and FIR digital Filters. (L2)
- Analyze windowing techniques in FIR filters. (L4)
- Illustrate the digital filters of different techniques. (L3)
- Design IIR and FIR filters. (L4)

TEXTBOOKS:

1. "Signals, Systems and Communications", B. P. Lathi, BS Publications, 2008.
2. "Digital signal processing, principles, Algorithms and applications", John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 4th Edition, 2007.
3. "Discrete Time Signal Processing", A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

REFERENCE BOOKS:

1. "Linear Systems and Signals", B. P. Lathi, Oxford University press, 2nd Edition.
2. "Digital Signal Processing – Fundamentals and Applications", Li Tan, Elsevier, 2008.
3. "Signals, Systems and Transforms", C. L. Philips, J. M. Parr and Eve A. Riskin, PE, 3rd Edition, 2004.
4. "Signals and Systems", A.V. Oppenheim, A.S. Willsky and S. H. Nawab, PHI, 2nd Edition, 2013.
5. "Signals and Systems", A. Anand Kumar, PHI Publications, 3rd Edition, 2013.

Course Code	OPERATING SYSTEMS CONCEPTS		L	T	P	C
21A050501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To gain knowledge about the Operating Systems concepts such as process, main memory management, secondary memory management, CPU and disk scheduling etc.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Describe the general architecture of computers **(K2)**

CO2: Describe, contrast and compare differing structures for operating Systems. **(K3)**

CO3: Analyse theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files. **(K4)**

CO4: Understand paging mechanism, virtual memory **(K2)**

CO5: Understand and identify the dead lock and methods to recovery the dead lock **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	2	1	-	-	-	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-	-	-
CO4	3	2	2	2	-	2	-	-	2	-	-	-	-	1
CO5	3	2	2	2	-	2	-	-	2	-	-	-	-	1

UNIT – I (9 Hrs)

Computer System and Operating System Overview: Overview of computer operating systems, operating systems functions, protection and security, distributed systems, special purpose systems, operating systems structures and systems calls, operating systems generation.

Learning Outcomes: At the end of this unit, students should be able to

- Identify major components of operating systems. (L1)
- Understand the types of computing environments. (L2)
- Explore several open-source operating systems. (L4)
- Recognize operating system services to users, processes and other systems. (L2)

UNIT – II (10 Hrs)

Process Management – Process concept- process scheduling, operations, Inter process communication. Multi Thread programming models. Process scheduling criteria and algorithms, and their evaluation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance, features of a process and methods of communication between processes. (L2)
- Examine CPU utilization through multi programming and multithreaded programming. (L3)

UNIT – III (8 Hrs)

Concurrency: Process synchronization, the critical- section problem, Peterson's Solution, synchronization Hardware, semaphores, classic problems of synchronization, monitors, Synchronization examples.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the various Problems of Process Synchronization. (L3)

UNIT – IV (8 Hrs)

Memory Management: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation Virtual Memory Management: virtual memory, demand paging, page-Replacement, algorithms, Allocation of Frames, Thrashing.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the various techniques of allocating memory to processes. (L3)
- Summarize how paging works in contemporary computer systems. (L4)
- Understanding the benefits of virtual memory systems. (L2)

UNIT – V (10 Hrs)

Principles of deadlock– system model, deadlock characterization, deadlock prevention, detection and avoidance, recovery form deadlock.

Learning Outcomes: At the end of this unit, students should be able to

- Investigate methods for preventing/avoiding deadlocks. (L4)
- Examine file systems and its interface in various operating systems. (L3)

TEXTBOOKS:

1. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, John Wiley, 7th Edition.
2. "Operating Systems – Internal and Design Principles", Stallings, Pearson education, 6th Edition, 2005.

REFERENCE BOOKS:

1. "Operating systems- A Concept based Approach", D. M. Dhamdhere, 2nd Edition, Tata McGraw Hill
2. "Operating System – A Design Approach", Crowley, TMH.
3. "Modern Operating Systems", Andrew S Tanenbaum, 3rd Edition, Prentice Hall International.

ONLINE LEARNING RESOURCES:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/Operating%20Systems/New_index1.html

Course Code	COMPUTER ARCHITECTURE & ORGANIZATION		L	T	P	C
21A050502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Principles and the Implementation of Computer Arithmetic
- Operation of CPUs including RTL, ALU, Instruction Cycle and Busses
- Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design
- Memory System and I/O Organization
- Principles of Operation of Multiprocessor Systems and Pipelining.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Develop a detailed understanding of computer systems **(K4)**

CO2: Cite different number systems, binary addition and subtraction, standard, floating-point, and micro-operations **(K3)**

CO3: Develop a detailed understanding of architecture and functionality of central processing unit **(K4)**

CO4: Exemplify in a better way the I/O and memory organization **(K3)**

CO5: Illustrate concepts of parallel processing, pipelining and inter processor communication. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating, Point Representation. Other Binary Codes, Error Detection Codes. Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Organization of Computers. (L2)
- Compare various Arithmetic Algorithms. (L5)

UNIT – II (10 Hrs)

Register Transfer Language and Micro operations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit. Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description.

Learning Outcomes: At the end of this unit, students should be able to

- Perform various functions using basic logical operations. (L5)
- Apply I/O and interrupts to execute various operations. (L4)

UNIT – III (8 Hrs)

Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Micro programmed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various addressing Modes. (L1)
- Compare various instruction formats. (L5)
- Design and other issues related to Control Unit. (L4)

UNIT – IV (8 Hrs)

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.

Learning Outcomes: At the end of this unit, students should be able to

- Compare various memories. (L3)
- Analyze various modes of transfer. (L5)

UNIT – V (8 Hrs)

Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration.

Pipeline: Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

Learning Outcomes: At the end of this unit, students should be able to

- Analyzing various processors. (L5)
- Compare various Pipeline. (L4)

TEXTBOOKS:

1. “Computer System Architecture”, M. Morris Mano, Pearson, 3rd Edition, 2008.
2. “Computer Organization”, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, McGraw Hill, 5th Edition, 2002.

REFERENCE BOOKS:

1. “Computer Organization and Architecture”, William Stallings, Pearson, 6th Edition, 2006.
2. “Structured Computer Organization”, Andrew S. Tanenbaum, Pearson, 4th Edition, 2005.
3. “Fundamentals of Computer Organization and Design”, Sivarama P. Dandamudi, Springer, 2006.

ONLINE LEARNING RESOURCES:

1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

OPEN ELECTIVE – II

Course Code	SMART GRID		L	T	P	C
21A020503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Impart knowledge on relevance smart grids technologies, its potential challenges and applications to the real world.
- Provide deeper insight on the customer's needs and consumption pattern for better load management and forecasting.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand the operational and functional aspects of smart grid, architecture and technical challenges. **(K2)**

CO2: Analyze the communication signals from various measuring units and sub-networks for monitoring secured operation adhering relevant standards. **(K4)**

CO3: Assess the various energy options and apply them for the sustainability of Smart grid. **(K2)**

CO4: Develop strategies for demand side management using various communication protocols. **(K3)**

CO5: Understand the challenges and relevant standards in interoperability and cyber security of Smart grid. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to Smart Grid: Introduction to smart grid as per National Institute Standards and Technology (NIST), smart grid architecture, functions of smart grid components, smart grid initiatives in India, technology drivers and challenges. Overview of the technologies required for smart grid and architecture of smart substation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concept of smart grid Technology. (L2)
- Explain Smart grid functions. (L3)
- Understand Smart grid architecture. (L2)

UNIT – II (9 Hrs)

Smart Grid Measurement Technology: Introduction, standards for information exchange, monitoring, smart meters, and measurement technologies, WAMS, PMUs, GIS and google mapping tools and multi-agent systems technology.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the measurement technologies. (L2)
- Explain the google mapping tools. (L3)
- Compare WAMS and PMU. (L3)

UNIT – III (9 Hrs)

Sustainable Energy Options for the Smart Grid: Renewable Energy Resources, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, Storage Technologies.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of Renewable energy source. (L3)
- Understand basic concept of Electric Vehicles. (L2)

UNIT – IV (9 Hrs)

Demand Side Management and Communication Technology: Introduction, Demand Side Management objectives and its classification. Communication technologies: IEEE 802X series. Layouts of Sub-networks: LAN, WAN, NAN, HAN and FAN and its comparison.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic concepts of management objectives. (L3)
- Compares the WAN, LAN, NAN, HAN. (L3)

UNIT – V (9 Hrs)

Interoperability, Standards and Cyber Security : Introduction, State-of-the-Art-Interoperability, Benefits and Challenges of Interoperability, Model for Interoperability in the Smart Grid Environment, Smart Grid Network Interoperability, Interoperability and Control of the Power Grid, Standards, Approach to Smart Grid Interoperability Standards, Smart Grid Cyber Security, Cyber Security State of the Art, Cyber Security Risks, cyber security concerns associated with Advanced Metering Infrastructure, Mitigation approach to cyber security risks.

Learning Outcomes: After successful completion of this unit, the students will be able to

- Understand basic Benefits and Challenges of Interoperability. (L2)
- Analyze Smart Grid Network Interoperability. (L4)

TEXTBOOKS:

1. "Smart Grid: Fundamentals of design and analysis", James Momoh, John Wiley & sons Inc, IEEE press, 2012
2. "Smart Grid: Technology and Applications", Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons Inc., 2012.

REFERENCE BOOKS:

1. "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Fereidoon P. Shoshonis, Academic Press, 2012
2. "The smart grid: Enabling energy efficiency and demand response", Clark Grellings, Fairmont Press Inc, 2009.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/107/108107113/
2. https://smartgrid.ieee.org/resources/webinars

Course Code	ENERGY STORAGE SYSTEMS		L	T	P	C
21A020504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need for energy storage
- Understand about the fundamentals of ESS
- Know about types, features and benefits of ESS
- Know about various management and control including market potential of ESS
- Study about various applications of ESS

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: To get exposed to latest technology of ESS. **(K3)**

CO2: Understand the principle, features, and benefits of ESS. **(K2)**

CO3: Understand the marketing and management strategies of ESS in working environment. **(K2)**

CO4: Distinguish wide variety of applications of EES for practical applications. **(K2)**

CO5: Know about latest technology applications of Battery SCADA, which is going to be vital in future applications, trend in new and renewable energy source. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Fundamentals of ESS: Definitions, Characteristics of ESS, Electricity, and roles of ESSs, Emerging needs in ESS, Classification of ESSs, Roles of Electrical storage technologies.

Learning Outcomes: At the end of the unit, students should be able to

- To know about the fundamentals of ESS. (L4)
- To know about emerging needs and roles of ESS. (L4)
- To know about various classifications of ESS. (L4)
- To understand about roles of energy storage technologies. (L2)

UNIT – II (9 Hrs)

Types and Features of ESS Technologies: Mechanical storage systems, Electromechanical storage systems, Chemical energy storage, Electrical storage systems, Thermal storage systems, standards for EES, Comparison of ESS technology storage systems, Power and discharge duration, Energy and power density, Storage operating cost, Power quality, Reactive power capability.

Learning Outcomes: At the end of the unit, students should be able to

- To understand about various types of ESS technologies. (L2)
- To understand about standards for ESS. (L2)
- To learn about power and discharge duration of ESS. (L2)
- To know about preliminaries of ESS operating cost. (L4)
- To understand about power quality issues and reactive power capability of ESS. (L2)

UNIT – III (9 Hrs)

Storage Benefits: Definitions, Applications, specifications, benefits, Electric energy time shift, Electric supply capacity, reserve capacity, voltage support, Electric service power quality and reliability, Incidental benefits, energy losses, access charges, Risk, dynamic operating benefits, p.f. correction, reduced air emissions, flexibility, energy benefits.

Learning Outcomes: At the end of the unit, students should be able to

- To know various storage benefits. (L4)
- To distinguish between application specific benefits and identical benefits. (L2)
- To understand about electric service power quality and reliability issues. (L2)
- To learn about energy benefits from storage systems. (L3)

UNIT – IV (9 Hrs)

EES Market and Management: Utility and Consumer use, Measurement and Control hierarchy, Internal configurations, External connections, Battery SCADA, Market potential, estimation, role of aggregators, Maximum market potential estimates, Demand change management, Time-of-use energy cost management, storage modularity.

Learning Outcomes: At the end of the unit, students should be able to

- To understand about management of ESS technologies. (L2)
- To distinguish between internal and external configuration of ESS. (L2)
- To know about battery SCADA system and storage modularity. (L4)
- To distinguish between demand change and time-of-use energy cost management. (L2)

UNIT – V (9 Hrs)

Applications of EES: Power Vs Energy, Capacity Vs energy applications, specific power and discharge durations, Electric supply applications, ancillary service applications, End user/utility customer applications, Distributed energy storage applications, Locational, Non-locational and incidental applications.

Learning Outcomes: At the end of the unit, students should be able to

- To know about various ESS. (L4)
- To distinguish between power, capacity, energy applications of ESS. (L2)
- To distinguish between electric supply and ancillary applications. (L2)
- To understand about the importance of distributed energy storage applications. (L2)

TEXTBOOKS:

1. "Energy Storage Benefits and Market Analysis", James M. Eyer, Joseph J. Iannucci and Garth P. Corey, Sandia National Laboratories, 2004
2. "The Electrical Energy Storage", IEC Market Strategy Board, White paper.

REFERENCE BOOKS:

1. "Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide", Jim Eyer, Garth Corey, Sandia National Laboratories", Feb 2010.

Course Code	AUTOMATION IN INDUSTRIES		L	T	P	C
21A030503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need of automation
- Classify various types of automated transmission lines and components of automation.
- List and understand various material handling systems.
- Design various types of automated assembly systems
- Explain various automatic inspection systems.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand principles and basic elements of automation. **(K2)**
CO2: Understand the Detroit automation and automated flow lines. **(K2)**
CO3: Learn the material handling technology and assembly systems. **(K1)**
CO4: Learn the control systems technology and its process in automation. **(K1)**
CO5: Understand the inspection, testing and PLC's in automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	3	1	2	1	-	-	-	-	-
CO2	3	-	-	-	2	2	1	-	2	-	-	-	-	-
CO3	3	-	-	-	1	1	1	-	1	-	-	-	-	-
CO4	2	2	3	-	3	2	2	-	2	-	-	-	-	-
CO5	2	-	-	-	2	1	2	-	1	-	-	-	-	-

UNIT – I (9 Hrs)

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break- Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in process.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principles of production, investment, cost concepts in automation. (L2)

UNIT – II (10 Hrs)

Detroit-Type Automation: Automated Flow lines, Methods of Work-part Transport, Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations.

Analysis of Automated Flow Lines: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the types of automation method concepts and machining operations. (L2)

UNIT – III (11 Hrs)

Material handling and Identification Technologies: The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc.

Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multistation Assembly Machines, Analysis of a Single Station Assembly Machine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Apply the techniques of material handling and automated assembly systems. (L4)

UNIT – IV (7 Hrs)

Control Technologies in Automation: Industrial Control Systems, Process Industries Verses Discrete- Manufacturing Industries, Continuous Verses Discrete Control, Computer Process Control and its Forms. Computer Based Industrial Control: Introduction & Automatic Process Control, Building Blocks of Automation System: LAN, Analog & Digital I/O Modules, SCADA System & RTU.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the industrial control technologies in automation. (L2)

UNIT – V (8 Hrs)

Automated Inspection and Testing: Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods.

Programmable Logic Controllers (PLCs): Introduction, Micro PLC, Programming a PLC, Logic Functions, Input & Output Modules, PLC Processors, PLC Instructions, Documenting a PLC System, Timer & Counter Instructions, Typical PLC Programming Exercises for Industrial Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the inspection, testing methods and PLC's methods in automation. (L2)

TEXTBOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing", M. P. Grover, Pearson Education.

REFERENCE BOOKS:

1. "Computer Based Industrial Control", Krishna Kant, EEE-PHI
2. "Principles and Applications of PLC", Webb John, Mcmillan 1992
3. "An Introduction to Automated Process Planning Systems", Tiess Chiu Chang & Richard A. Wysk
4. "Anatomy of Automation", Amber G.H & P.S. Amber, Prentice Hall.

Course Code	RAPID PROTOTYPING		L	T	P	C
21A030504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- The fundamental Theory behind RP process.
- Study the Process parameters of different machine.
- Study different types of Rapid tooling.
- Based on the industrial standards, learn how Prepare manufacturing DATA.
- The basics concept of different software used in RP system.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand Theory behind RP process. **(K2)**
CO2: Learn the Process parameters of different machine. **(K3)**
CO3: Learn different types of Rapid tooling. **(K3)**
CO4: Understand the industrial standards; learn how to prepare manufacturing Data. **(K2)**
CO5: Understand basics concept of different software used in RP system. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	2	3	1	2	-	-	1	-	-	-	-
CO2	2	2	-	3	2	2	2	-	-	1	-	-	-	-
CO3	3	2	-	3	2	1	3	-	-	1	-	-	-	-
CO4	1	2	-	3	3	1	3	-	-	1	-	-	-	-
CO5	1	2	-	3	3	1	3	-	-	1	-	-	-	-

UNIT – I (9 Hrs)

Introduction & History of Rapid Prototyping, Fundamentals of Rapid Prototyping, Advantages and Disadvantages of Rapid Prototyping, Applications of Rapid Prototyping, Classification of RP, Rapid prototyping process chain, Fundamental Automated processes.

Learning Outcomes**:** At the end of this unit, students should be able to

- Know about the importance of rapid prototyping. (L1)
- Understand the concept of Stereo lithography. (L2)

UNIT – II (9 Hrs)

Stereo lithography (SLA) system & principle, Process parameter, process details of SLA, Data preparation, data files of SLA, Machine details & Application of SLA.

Selective Laser Sintering (SLS)- Introduction, SLS Machine Type – Details, SLS principle of operation, Process parameters of SLS, Data preparation for SLS.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about the selective laser sintering process. (L4)
- Explain about the concept of fused deposition modelling and solid ground curing. (L2)

UNIT – III (7 Hrs)

Fused Deposition Modeling (FDM) – Introduction, FDM Principles, Process Parameters, Path generation & Application of FDM, Solid Ground curing (SGC) - Principle of operation, SGC machine details & application. Laminate Object Manufacturing (LOM) - Principle of operation, LOM materials, LOM Process details & Application.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Demonstrate about laminated object manufacturing process. (L2)
- Know about different 3D modelling printing techniques. (L1)

UNIT – IV (10 Hrs)

Rapid tooling -Indirect rapid tooling, Silicon Rubber tooling, Aluminium filling epoxy tooling, Spray metal tooling, Direct rapid tooling, Quick cast process, copper Polyamide, DMILS – explanation, Prometals, sand casting tooling, Soft tooling & hard tooling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of rapid tolling. (L2)

UNIT – V (10 Hrs)

Rapid Manufacturing – Introduction, Factors influencing accuracy, Data preparation errors, Part building errors, Errors in finishing, Influence of build orientation.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand different file format software's of 3D modelling techniques. (L2)

TEXTBOOKS:

1. "Stereo lithography and other RP & M Technologies", Paul F. Jacobs, SME, NY 1996.
2. "Rapid Manufacturing", Flham D. T & Dinjoy S.S, Verlog London 2001.
3. "Rapid automated", Lament wood, Indus press New York.

REFERENCE BOOKS:

1. "Wohler's Report 2000", Terry Wohlers, Wohler's Association, 2000.
2. "Rapid prototyping materials", Gurumurthi, IISc Bangalore

Course Code	PRINCIPLES OF COMMUNICATION SYSTEMS		L	T	P	C
21A040503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

COURSE OUTCOMES:

At the end of this course, student will be able to

CO1: Apply the concept of amplitude modulation to solve engineering problems. **(K3)**
CO2: Analyze the Angle modulation & demodulation systems in time & frequency domains. **(K4)**
CO3: Analyze different Analog Pulse modulation & demodulation techniques. **(K4)**
CO4: Explain various digital modulation schemes. **(K3)**
CO5: Understand the concept of various communication systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Amplitude Modulation: An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of noise, Fourier transform, career modulation and frequency division multiplexing. (L2)
- Apply the concept of amplitude modulation to solve engineering problems. (L3)

UNIT – II (9 Hrs)

Angle Modulation: Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of angle modulation and its components. (L2)
- Apply the concept of frequency modulation to solve engineering problems. (L3)
- Analyse angle modulation schemes. (L4)
- Evaluate frequency modulation scheme in real time applications. (L4)

UNIT – III (8 Hrs)

Pulse Modulation: Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing. (L2)
- Explain various pulse modulation schemes. (L4)

UNIT – IV (9 Hrs)

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various digital modulation schemes. (L2)
- Analyze various digital modulation schemes. (L4)

UNIT – V (9 Hrs)

Communication Systems: Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various communication systems. (L2)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Principles of Communication Systems", Herbert Taub, Donald L Schilling and Goutam Saha, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

REFERENCE BOOKS:

1. "Modern Digital and Analog Communication Systems", B. P. Lathi, Zhi Ding and Hari M. Gupta, 4th Edition, Oxford University Press, 2017.

2. "Digital and Analog Communication Systems", K. Sam Shanmugam, Wiley India Edition, 2008.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108104091
2. https://www.eeeguide.com/principles-of-communication-systems
3. https://ncert.nic.in/ncerts/l/leph207.pdf

Course Code	ELECTRONIC INSTRUMENTATION		L	T	P	C
21A040504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

This course will enable students to

- To introduce various measuring instruments and their functionality.
- To teach various measurement metrics for performance analysis.
- To explain principles of operation and working of different electronic instruments.
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.
- To provide exposure to different types of transducers.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand the different methods for measurement of various electrical quantities. **(K2)**
CO2: Compare the various measuring techniques for measuring voltage. **(K4)**
CO3: Measure amplitude and frequency utilizing oscilloscopes. **(K5)**
CO4: Analyze the functioning of various types of probes, derive the balanced condition for various bridges. **(K4)**
CO5: Measure various physical parameters by appropriately selecting the transducers. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (10 Hrs)

Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. **Ammeters:** DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. **Voltmeters and Multi-meters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of measurement system. (L2)

- Explain the characteristics of different Instruments. (L2)
- Illustrate different types of errors that may occur in instruments during measurements. (L2)

UNIT – II (9 Hrs)

Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM.

Digital Instruments: Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

Learning Outcomes: At the end of this unit, students should be able to

- Explain working of digital measuring Instruments. (L2)
- Compare the various measuring techniques for measuring voltage. (L4)

UNIT – III (9 Hrs)

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope.

Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator.

Learning Outcomes: At the end of this unit, students should be able to

- Measure parameters viz. Amplitude, frequency and time period using CRO. (L5)
- Classify signal generators and describe its characteristics. (L2)

UNIT – IV (8 Hrs)

Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger.

Bridges: Introduction, Wheatstone‘s bridge, Kelvin‘s Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell‘s bridge, Wien‘s bridge.

Learning Outcomes: At the end of this unit, students should be able to

- Describe function of various measuring Instruments. (L2)
- Describe how unknown capacitance and inductance can be measured using bridges. (L2)
- Select appropriate bridge for measuring R, L and C parameters. (L2)
- Analyze the functioning of various types of probes derive the balanced condition for various bridges. (L4)

UNIT – V (9 Hrs)

Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of transducer. (L2)
- Measure various physical parameters by appropriately selecting the transducers. (L5)

TEXTBOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, McGraw Hill, 3rd Edition, 2012, ISBN: 9780070702066.
2. "Modern Electronic Instrumentation and Measuring Techniques", A. D. Helfrick and W.D. Cooper, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

REFERENCE BOOKS:

1. "Electronic Instrumentation & Measurements", David A. Bell, Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.
2. "Electronics and Electrical Measurements", A. K. Sawhney, Dhanpat Rai &Sons. ISBN - 81-7700-016-0

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/108105064/
2. http://nptel.ac.in/courses/108105062/

Course Code	JAVA PROGRAMMING		L	T	P	C
21A050503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Focus on object oriented concepts and java program structure and its installation.
- Comprehension of java programming constructs, control structures in Java.
- Implementing Object oriented constructs such as various class hierarchies, interfaces and exception handling.
- Understanding of Thread concepts and I/O in Java.
- Being able to build dynamic user interfaces using applets and Event handling in java.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Use of objects to program. **(K3)**
CO2: Create programs by using Java basic Constructs. **(K3)**
CO3: Implement OOPs concepts. **(K3)**
CO4: Develop JAVA applets applications. **(K4)**
CO5: Apply multi-threaded concepts in programming. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	-	-	2	2	3	2	-	3	2
CO2	3	2	3	2	3	-	-	2	2	3	-	-	3	2
CO3	3	2	2	1	3	-	-	2	2	3	-	1	1	2
CO4	3	2	2	2	3	-	-	2	2	3	1	-	1	2
CO5	3	2	2	2	3	-	-	2	2	3	1	1	1	2

UNIT – I (8 Hrs)

Introduction to OOP: Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6

Learning Outcomes: At the end of this unit, students should be able to

- Understand the syntax, semantics and features of Java Programming Language. (L1)
- Compare Object Oriented and Procedural Languages. (L4)

UNIT – II (9 Hrs)

Programming Constructs: Variables, Primitive Data types, Identifiers- Naming Coventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules and

Associativity, Primitive Type Conversion and Casting, Flow of control- Branching, Conditional, loops. Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments.

Learning Outcomes: At the end of this unit, students should be able to

- Developing simple programs with java constructs. (L5)
- Learning about various Keywords in Java and their uses. (L1)

UNIT – III (9 Hrs)

Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class. Interfaces, Packages and Enumeration: Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages, using Packages, Access protection, java.lang package. Exceptions & Assertions – Introduction, Exception handling techniques- try catch, throw, throws, finally block, user defined exception.

Learning Outcomes: At the end of this unit, students should be able to

- Implement types of Inheritance and developing new classes based on existing classes. (L4)
- Distinguish between system packages and user defined packages. (L4)
- Demonstrate features of interfaces to implement multiple inheritances. (L3)
- Applying Exception in Programs where necessary. (L4)

UNIT – IV (6 Hrs)

Multi Threading: java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading-Synchronization, suspending and Resuming threads, Communication between Threads Input / Output: reading and writing data, java.io package

Learning Outcomes: At the end of this unit, students should be able to

- Understand concurrency, parallelism and multithreading. (L2)
- Create multitasking applications. (L5)

UNIT – V (9 Hrs)

Applets– Applet class, Applet structure, An Example Applet Program, Applet : Life Cycle, paint(), update() and repaint() Event Handling -Introduction, Event Delegation Model, java.awt. event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the GUI programming. (L2)
- Perform event Handling in java GUI Programs. (L5)

TEXTBOOKS:

1. "The Complete Reference Java", Herbert Schildt, TMH, 8th Edition
2. "Programming in JAVA", Sachin Malhotra, Saurabh choudhary, Oxford.
3. "JAVA for Beginners", Joyce Farrell, Ankit R. Bhavsar, Cengage Learning, 4th Edition.
4. "Object oriented programming with JAVA, Essentials and Applications", Raj Kumar Bhuyya, Selvi, Chu TMH.
5. "Introduction to Java Programming", Y Daniel Liang, Pearson, 7th Edition.

REFERENCE BOOKS:

1. "JAVA Programming", K. Rajkumar. Pearson.
2. "Core JAVA, Black Book", Nageswara Rao, Wiley, Dream Tech
3. "Core JAVA for Beginners", Rashmi Kanta Das, Vikas.
4. "Object Oriented Programming through JAVA", P Radha Krishna, University Press.

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/java/
2. https://www.javatpoint.com/java-tutorial

Course Code	BASICS OF DATABASE MANAGEMENT SYSTEMS		L	T	P	C
21A050504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Provides students with theoretical knowledge and practical skills in the use of databases.
- Database management systems in information technology applications.
- The logical design, physical design and implementation of relational databases are covered.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Define a Database Management System. **(K2)**
CO2: Compare the advantages and disadvantages of the different models. **(K4)**
CO3: Design Database using E-R Diagram (SQL). **(K4)**
CO4: Analyze the rules guiding transaction ACID properties. **(K4)**
CO5: Analyze file organization while storing and retrieving the data base **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	-	2	1	1	2	3	2
CO2	3	2	1	2	1	1	-	-	2	-	1	2	3	2
CO3	3	3	2	2	1	-	-	-	2	-	2	2	1	2
CO4	3	3	2	2	1	-	-	-	2	-	2	2	1	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	1	2

UNIT – I (10 Hrs)

INTRODUCTION: Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Data base systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between Database and File System. (L4)
- Categorize different kinds of data models. (L4)
- Define functional components of DBMS. (L2)

UNIT – II (8 Hrs)

RELATIONAL MODEL: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance **BASIC SQL:** Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

Learning Outcomes: At the end of this unit, students should be able to

- Outline the elements of the relational model such as domain, attribute, tuple, relation and entity. (L2)
- Distinguish between various kinds of constraints like domain, key and integrity. (L4)
- Define relational schema Develop queries using Relational Algebra and SQL. (L2)
- Perform DML operations on databases. (L4)

UNIT – III (8 Hrs)

ENTITY RELATION MODEL: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. **SQL:** Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations.

Learning Outcomes: At the end of this unit, students should be able to

- Develop E-R model for the given problem. (L4)
- Derive tables from E-R diagrams. (L4)

UNIT – IV (8 Hrs)

TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods: lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes, Database Recovery management : Transaction recovery. SQL constructs that grant access or revoke access from user or user groups. Basic PL/SQL procedures, functions and triggers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various properties of transaction. (L1)
- Design atomic transactions for an application. (L4)
- Gain the knowledge about log mechanism and check pointing techniques for system recovery. (L2)
- Create PLSQL programs and triggers for different database conditions. (L5)

UNIT – V (9 Hrs)

STORAGE AND INDEXING: Database file organization, file organization on disk, heap files and sorted files, hashing, single and multi-level indexes, dynamic multilevel indexing using B-Tree and B+ tree, index on multiple keys.

Learning Outcomes: At the end of this unit, students should be able to

- Understand file organization (L2)
- Compare various indexing techniques (L4)

TEXTBOOKS:

1. "Database Management Systems", Raghuram Krishnan, Johannes Gehrke, TMH, 3rd Edition
2. "Database Management System", Ramez Elmasri, Shamkant B. Navathe, PEA, 6th Edition
3. "Database Principles Fundamentals of Design Implementation and Management", Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

REFERENCE BOOKS:

1. "Database System Concepts", Silberschatz, Korth, TMH, 5th Edition
2. "Introduction to Database Systems", C J Date, PEA, 8th Edition

WEBLINKS

1. https://www.javatpoint.com/dbms-tutorial
2. https://www.geeksforgeeks.org/dbms/

OPEN ELECTIVE – III

Course Code	RENEWABLE ENERGY SYSTEMS		L	T	P	C
21A020505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand various alternate sources of energy for different suitable application requirements. **(K2)**
CO2: Understand the concepts of solar energy generation strategies and wind energy system. **(K2)**
CO3: Analyze Solar and Wind energy systems. **(K4)**
CO4: Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass, and fuel cells. **(K2)**
CO5: Understand the fundamentals of Solar and Wind energy systems. **(K2)**

CO-POMAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

Learning Outcomes: At the end of the unit, students should be able to

- Understanding renewable and nonrenewable energy resources. (L2)
- Understand the various forms of conventional energy resources. (L2)
- Understanding of Solar power properties. (L2)

UNIT – II (8 Hrs)

PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the PV cells and modules. (L2)
- Disseminate information on PV. (L3)

UNIT – III (10 Hrs)

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

Learning Outcomes: At the end of the unit, students should be able to

- Understanding of wind energy production. (L2)
- Outline division aspects and utilization of renewable energy sources for both domestics and industrial application. (L3)
- Understand the need of Wind Energy and the various components used in energy generation and know the classification. (L2)

UNIT – IV (8 Hrs)

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Learning Outcomes: At the end of the unit, students should be able to

- Identify the Resources of geothermal energy.(L2)

UNIT – V (10 Hrs)

Miscellaneous Energy Technologies: Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the concept of Biomass energy resources and their classification. (L2)
- Analyze the performance of Ocean Energy. (L4)

TEXTBOOKS:

1. "Renewable Energy Power for a Sustainable Future", Stephen Peake, Oxford International Edition, 2018.
2. "Non-Conventional Energy Sources", G. D. Rai, Khanna Publishers, 4th Edition, 2000.

REFERENCE BOOKS:

1. "Solar Energy", S. P. Sukhatme, Tata Mc Graw Hill Education Pvt. Ltd, 3rd Edition, 2008.
2. "Non-Conventional Energy Resources", B H Khan, Tata Mc Graw Hill Education Pvt Ltd, 2nd Edition, 2011.
3. "Non-Conventional Energy Resources", S. Hasan Saeed and D. K. Sharma, S. K. Kataria & Sons, 3rd Edition, 2012
4. "Renewable Energy Resource: Basic Principles and Applications", G. N. Tiwari and M. K. Ghosal, Narosa Publishing House, 2004

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

Course Code	CONCEPTS OF ELECTRICAL DRIVES AND APPLICATIONS		L	T	P	C
21A020506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Identify the choice of the electric drive system based on their applications. **(K2)**
CO2: Explain the operation of single and multi-quadrant electric drive. **(K3)**
CO3: Analyze single phase and 3-phase rectifiers fed DC motors and chopper fed DC motors. **(K4)**
CO4: Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors with closed loop, and open loop operations. **(K3)**
CO5: Explain the speed control methods for AC-AC & DC-AC converters fed to Synchronous motors with closed loop, and open loop operations. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Converter Fed DC Motors: Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase semi and fully controlled converters connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic electrical drive elements and its function. (L2)
- Analyze the single-phase dc drives and its speed-torque characteristics. (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – II (9 Hrs)

Four Quadrant Operation of DC Drives: Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only).

Learning Outcomes: At the end of the unit, students should be able to

- Understand the four-quadrant operation of the dc drives. (L2)
- Analyze the various motoring and braking operations of the dc motors. (L4)
- Understand the closed loop operation of the dc drives. (L2)

UNIT – III (9 Hrs)

Chopper fed DC Motors: Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics– Problems on Chopper Fed D.C Motors.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basics concepts of choppers and its operation. (L2)
- Analyze the classification of various choppers feeding the dc drives. (L4)

UNIT – IV (9 Hrs)

Control of Induction Motor: Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers–Waveforms – Speed Torque Characteristics - Stator Frequency Control and characteristics. Voltage Source and Current Source Inverter – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Static Rotor Resistance Control

Learning Outcomes: At the end of the unit, students should be able to

- Understand the various speed control methods of induction motor used in drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods to induction motor on rotor side. (L3)

UNIT – V (9 Hrs)

Control of Synchronous Motors: Separate Control & Self Control of Synchronous Motors – Operation of Self-Controlled Synchronous Motors by VSI and CSI. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque Characteristics – Applications – Advantages.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the self and separate control methods of synchronous motor drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)

- Apply the various speed control methods of synchronous motors. (L4)

TEXTBOOKS:

1. "Power semiconductor-controlled drives", G K Dubey, Prentice Hall, 1995.
2. "Modern Power Electronics and AC Drives", B. K. Bose, PHI, 2002.

REFERENCE BOOKS:

1. "Power Electronics", MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. "Power Electronic Circuits, Devices and applications", M. H. Rashid, PHI, 2005.
3. "Electric drives Concepts and Applications", Vedam Subramanyam, Tata McGraw Hill Publications, 2nd Edition, 2011.

Course Code	OPTIMIZATION TECHNIQUES		L	T	P	C
21A030505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the basic fundamentals of optimization methods that can be used during a design process.
- To expose the students to different modern optimization techniques.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand basic theoretical principles of optimization models and its solution. **(K2)**
CO2: Formulate the given practical problem and solving by graphical /simplex method. **(K3)**
CO3: Analyse the cost for transportation and assigning the jobs to machines. **(K3)**
CO4: Analyse the cost and duration of the project, also preparation of job scheduling. **(K3)**
CO5: Use latest methods for optimization. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	1	2	2	1	-	-
CO2	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO3	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO4	3	3	3	3	-	2	-	1	1	-	2	1	-	-
CO5	3	3	3	3	2	2	-	-	2	-	2	1	-	-

UNIT – I (10 Hrs)

Introduction to Optimization: Classification of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems.

Classical Optimization Techniques: Single variable optimization, Multi-variable: Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain how to formulate statement of optimization problem with or without constraints. (L3)
- Explain about classification of single and multivariable optimization problems. (L3)
- Know about necessary and sufficient conditions in defining the optimization problems. (L1)
- Understand how to formulate Kuhn-Tucker conditions and to solve numerical problems. (L3)

UNIT – II (8 Hrs)

Linear Programming: Statement of an LP problem, Graphical Solution of an LP problem, Simplex method, Two phase method, Dual simplex method.

Learning Outcomes: At the end of this unit, students should be able to

- Formulation of problem as LPP. (L4)
- Solve numerical problems with graphical method, Simplex method, two phase method and dual simplex method. (L4)

UNIT – III (9 Hrs)

Transportation Problems: Introduction, Optimal Solution for BFS, Unbalanced Transportation Problem, Transshipment, Assignment Problems, Hungarian Method.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Model linear programming problems like the transportation. (L6)
- Solve the problems of transportation from origins to destinations with minimum time and cost. (L3)
- Solve assignment problems. (L4)

UNIT – IV (10 Hrs)

Project Management: Introduction, Critical Path Method, Critical Path Determination, Optimal Scheduling by CPM, Project Evaluation and Review Technique.

Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

Learning Outcomes: At the end of this unit, students should be able to

- Represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project. (L4)
- Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability. (L4)
- Solve problems of production scheduling. (L3)

UNIT – V (8 Hrs)

Modern Methods of Optimization: An overview of evolutionary algorithms, Genetic algorithms, simulated annealing, fuzzy optimization, neural-network based methods, Particle swarm optimization.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Solve the numerical problems using modern optimization techniques. (L4)

TEXTBOOKS:

1. "Engineering Optimization- Methods and Applications", A. Ravindran, K. M. Ragsdell, G.V. Reklaitis, Wiley India Edition, 2nd Edition.
2. "Operations Research: An Introduction", H.A. Taha, PHI Pvt. Ltd., 6th Edition

REFERENCE BOOKS:

1. "Introduction to Optimum Design", J S Arora, Mc-Graw Hill.
2. "Optimization Methods for Engineering Design", Fox, R. L., Addison Wesley, 2001.
3. "Multi-objective optimization using evolutionary algorithms", K Deb John Wiley Publications.
4. "Operations Research", Dr. J. K. Sharma, Mc Millan.
5. "Engineering Optimization: Theory and Practice", Singiresu S. Rao, John Wiley & Sons

Course Code	GLOBAL WARMING AND CLIMATE CHANGES		L	T	P	C
21A030506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To know the basics, importance of global warming.
- To know the concepts of mitigation measures against global warming
- To know the impacts of climate changes

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Know the impact of Ozone layer on green house effect and global warming. **(K1)**
CO2: Understand the structure of atmosphere and effects of inversion on pollution dispersion. **(K2)**
CO3: Know the effect of global warming and climatic changes on environment. **(K1)**
CO4: Understand Global change in temperature and climate and measures to reduce the effect. **(K2)**
CO5: Understand the clean technology, use of renewable energy, mitigation technologies and their practices **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO5	1	2	-	2	-	-	-	-	2	-	-	2	-	-

UNIT – I (7 Hrs)

EARTH'S CLIMATE SYSTEM:

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Green house gases and green house effect, Hydrological cycle and Carbon cycle, Global warming and its impacts

Learning Outcomes: At the end of this unit, students should be able to

- Identity the importance of Ozone and effect of green house gases. (L1)
- Know the effect of global warming. (L1)

UNIT – II (9 Hrs)

ATMOSPHERE & ITS COMPONENTS: Atmosphere and its layers-Characteristics of Atmosphere - Structure of Atmosphere - Composition of Atmosphere - Atmospheric stability -

Temperature profile of the atmosphere - Temperature inversion and effects of inversion on pollution dispersion.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the layers of atmosphere and their characteristics. (L1)

UNIT – III (8 Hrs)

IMPACTS OF CLIMATE CHANGE: Causes of Climate change - Change of Temperature in the environment - Melting of ice and sea level rise - Impacts of Climate Change on various sectors - Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and its effects on various sectors. (L1)

UNIT – IV (10 Hrs)

OBSERVED CHANGES AND ITS CAUSES: Climate change and Carbon credits-Clean Development Mechanism (CDM), CDM in India - Kyoto Protocol - Intergovernmental Panel on Climate Change (IPCC) - Climate Sensitivity - Montreal Protocol - United Nations Framework Convention on Climate Change (UNFCCC) - Global change in temperature and climate and changes within India

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and carbon credits, effect of change in temperature and climate on India. (L1)

UNIT – V (11 Hrs)

CLIMATE CHANGE AND MITIGATION MEASURES: CDM and Carbon Trading - Clean Technology, biodiesel, compost, biodegradable plastics - Renewable energy usage as an alternative - Mitigation Technologies and Practices within India and around the world - Non-renewable energy supply to all sectors - Carbon sequestration - International and regional cooperation for waste disposal biomedical wastes, hazardous wastes, e-wastes, industrial wastes, etc.,

Learning Outcomes: At the end of this unit, students should be able to

- Know about the clean technology, use of renewable energy, mitigation technologies and their practices. (L1)

TEXTBOOKS:

1. “Climate Change – An Indian Perspective”, Dash Sushil Kumar, Cambridge University Press India Private limited 2007.

REFERENCE BOOKS:

1. "Adaptation and mitigation of climate change-Scientific Technical Analysis", Cambridge University Press, Cambridge, 2006.
2. "Atmospheric Science", J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3. "Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Jan C. van Dam, Cambridge university press, 2003.
4. "Global Warming: Understanding the Forecast"", David Archer, Wiley, 2nd Edition, 2011
5. "Global Warming: The Complete Briefing", John Houghton, Cambridge University Press, 5th Edition, 2015

Course Code	ELECTRONIC SENSORS		L	T	P	C
21A040505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To learn the characterization of sensors.
- To know the working of Electromechanical, Thermal, Magnetic and radiation sensors
- To understand the concepts of Electro analytic and smart sensors
- To be able to use sensors in different applications.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the Principles of different sensors, Characterization and working of Electro mechanical Sensors. **(K3)**
CO2: Analyze the working of Thermal sensors. **(K4)**
CO3: Compare the working of magnetic resistor and hall effect sensors. **(K4)**
CO4: Explain the working of radiation and Electro analytic Sensors. **(K3)**
CO5: Develop a system with smart sensors. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (9 Hrs)

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of sensors/Transducers principles. (L2)
- Understand the concepts of Electro mechanical sensors. (L2)
- Identify the operation of Inductive and capacitive sensors. (L3)

UNIT – II (9 Hrs)

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Thermal sensors. (L2)
- Understand the working of Thermal radiation sensors. (L2)
- Identify the types of semiconductor sensors. (L3)
- Analyse the operation of heat flux sensors. (L4)

UNIT – III (9 Hrs)

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principles of Magnetic sensors. (L2)
- Summarize the concepts of Angular transducers. (L2)
- Compare the working of magnetic resistor and Hall effect sensors. (L4)

UNIT – IV (9 Hrs)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors, Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of radiation sensors. (L2)
- Summarize the types of photo detectors. (L2)
- Explain different electrodes and sensors. (L3)

UNIT – V (9 Hrs)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications, Introduction- On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of smart sensors. (L2)
- Summarize the applications of automation sensor. (L2)
- Develop different sensors used in the industries and manufacturing. (L3)

TEXTBOOKS:

1. "Sensors and Transducers", D. Patranabis, PHI Learning Private Limited., 2003.
2. "Introduction to sensors", John veteline, Aravind Raghu, CRC press, 2011

REFERENCE BOOKS:

1. "Sensors and Actuators", D. Patranabis, PHI, 2nd Edition, 2013.
2. "Make sensors", Tero Karvinen, Kimmo Karvinen and Ville Valtokari, Maker media, 1st Edition, 2014.
3. "Sensors handbook", Sabrie Soloman, TMH, 2nd Edition, 2009

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108147
2. http://www.nitttrc.edu.in/nptel/courses/video/101104066/101104066.html

Course Code	INTRODUCTION TO IMAGE PROCESSING		L	T	P	C
21A040506			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce fundamentals of Image Processing.
- To expose various intensity transformations in spatial and frequency domains.
- To impart concepts of wavelets and various coding techniques for image compression.
- To dissimilate various segmentation techniques for images.
- To teach various color models and to introduce the concepts of color image segmentation.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Analyze various types of images mathematically. **(K4)**
CO2: Compare image enhancement methods in spatial and frequency domains. **(K3)**
CO3: Apply various segmentation algorithms for processing an image. **(K3)**
CO4: Categorize various compression techniques and color models. **(K4)**
CO5: Apply various techniques for color image smoothing, sharpening and segmentation. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO4	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels: neighbourhood, adjacency, connectivity, distance measures. Mathematical tools/ operations applied on images.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic building blocks of image processing. (L2)
- Define image processing parameters such as adjacency and distance measures. (L1)
- Analyze various types of images mathematically. (L4)

UNIT – II (9 Hrs)

Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain

sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Learning Outcomes: At the end of this unit, students should be able to

- Apply spatial domain and frequency Domain filtering techniques for image enhancement (L3)
- Compare image enhancement methods in spatial and frequency domains. (L3)

UNIT – III (9 Hrs)

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various Image segmentation techniques. (L2)
- Illustrate detection of discontinuities in an image. (L2)
- Apply various segmentation algorithms for processing an image. (L3)

UNIT – IV (9 Hrs)

Image Compression: Redundancy, inter-pixel and psycho-visual; Loss less compression-predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various transform techniques for lossy compression. (L2)
- Apply various coding techniques for lossless compression. (L3)

UNIT – V (9 Hrs)

Color Image Processing: Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various color models for color image processing. (L2)
- Apply various techniques for color image smoothing, sharpening and segmentation. (L3)

TEXTBOOKS:

1. "Digital Image Processing", R.C. Gonzalez and R.E. Woods, Pearson Education, 2nd Edition, 2008.
2. "Fundamentals of Digital Image Processing", Anil Kumar Jain, Prentice Hall of India, 2nd Edition 2004.

REFERENCE BOOKS:

1. “Digital Image processing using MATLAB”, Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Tata McGraw Hill, 2010.
2. “Image Processing, Analysis, and Machine Vision”, Milan Sonka, Vaclav Hlavac, Roger Boule, Cengage Learning, 3rd Edition, 2016.
3. “Digital Image processing”, S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.
4. “Digital Image Processing”, William K. Pratt, John Wiley, 3rd Edition, 2004.

ONLINE LEARNING RESOURCES:

1. https://www.udemy.com/course/learn-image-analysis/
2. https://alison.com/tag/image-processing
3. https://nptel.ac.in/courses/117/105/117105135/

Course Code	INTRODUCTION TO INTERNET OF THINGS		L	T	P	C
21A050505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

COURSE OUTCOMES:

At the end of the unit, students will be able to

CO1: Analyze various protocols for IoT. **(K4)**
CO2: Design a PoC of an IoT system using Raspberry Pi/Arduino. **(K3)**
CO3: Apply data analytics and use cloud offerings related to IoT. **(K3)**
CO4: Analyze applications of IoT in real time scenario. **(K4)**
CO5: Analyze applications of IoT in real time Applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	-	2	1	1	2	3	-
CO2	3	2	1	2	1	1	-	-	2	-	1	2	3	-
CO3	3	3	2	2	1	-	-	-	2	-	2	2	3	-
CO4	3	3	2	2	1	-	-	-	2	-	2	2	3	-
CO5	3	3	2	2	1	-	-	-	2	-	2	2	3	-

UNIT – I (10 Hrs)

FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain IoT architecture. (L2)
- Interpret the design principles that govern connected devices. (L2)
- Summarize the roles of various organizations for IoT. (L2)
- Interpret the significance of Prototyping. (L2)

UNIT – II (10 Hrs)

IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basics of microcontrollers. (L2)
- Outline the architecture of Arduino. (L2)
- Develop simple applications using Arduino. (L3)
- Outline the architecture of Raspberry Pi. (L2)
- Develop simple applications using Raspberry Pi. (L3)
- Select a platform for a particular embedded computing application. (L3)

UNIT – III (8 Hrs)

DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

Learning Outcomes: At the end of this unit, students should be able to

- Interpret different protocols and compare them. (L2)
- Select which protocol can be used for a specific application. (L3)
- Utilize the Internet communication protocols for IoT applications. (L3)
- Select IoT APIs for an application. (L3)
- Design and develop a solution for a given application using APIs. (L6)
- Test for errors in the application. (L4)

UNIT – IV (8 Hrs)

DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

Learning Outcomes: At the end of this unit, students should be able to

- Plan the business model. (L6)
- Predict the market value. (L6)
- Build the product. (L6)

UNIT – V (9 Hrs)

CASE STUDIES/INDUSTRIAL APPLICATIONS: Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the manufacturing techniques. (L2)
- Adapt the Ethics of the IoT. (L6)

TEXTBOOKS:

1. "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

REFERENCE BOOKS:

1. "Database System Concepts", Silberschatz, Korth, TMH, 5th Edition
2. "Introduction to Database Systems", C J Date, PEA, 8th Edition
3. "The Database book principles & practice using Oracle/MySql", Narain Gehani, University Press.

ONLINE LEARNING RESOURCES:

1. https://en.wikipedia.org/wiki/Cloud_computing
2. https://www.infoworld.com/article/2683784/what-is-cloud-computing.html

Course Code	WEB TECHNOLOGIES FOR BEGINNERS		L	T	P	C
21A050506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- This course is designed to introduce students with no programming experience to the programming languages
- Techniques associated with the World Wide Web.
- The course will introduce web-based media-rich programming tools for creating interactive web pages.

COURSE OUTCOMES:

After completing the course student will be able to

CO1: Analyze a web page and identify its elements and attributes. **(K4)**
CO2: Create web pages using XHTML and Cascading Styles sheets. **(K5)**
CO3: Build dynamic web pages. **(K5)**
CO4: Build web applications using PHP. **(K5)**
CO5: Programming through PERL and Ruby, client-side scripts using AJAX **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	3	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	3	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	3	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	3	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	3	-

UNIT – I (9 Hrs)

HTML tags, Lists, Tables, Images, forms, Frames. Cascading style sheets. Introduction to Java script. Objects in Java Script. Dynamic HTML with Java Script

Learning Outcomes: At the end of this unit, students should be able to

- Create standard tags of HTML tags and Knowing the features of designing static web pages. (L6)
- List different types of CSS to design webpage attractively. (L1)
- Apply Java script concepts and create dynamic HTML pages. (L4)

UNIT – II (10 Hrs)

Working with XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how XML interacts with different applications. (L1)
- Examine background applications using XSL and XSLT. (L4)

<u>UNIT – III</u> (9 Hrs)

AJAX A New Approach: Introduction to AJAX, Integrating PHP and AJAX. Consuming WEB services in AJAX: (SOAP, WSDL, UDDI)

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of AJAX Architecture. (L2)
- Integrate and test web services. (L5)

<u>UNIT – IV</u> (9 Hrs)

PHP Programming: Introducing PHP: Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements, Arrays, functions. Working with forms and Database such as my Sql.

Learning Outcomes: At the end of this unit, students should be able to

- Develop PHP Programs using WAMP and XAMPP Server. (L3)
- Create a website with a Database (My SQL) in PHP. (L5)

<u>UNIT – V</u> (8 Hrs)

Introduction to PERL, Perl language elements, Interface with CGI- A form to mail program, Simple page search

Learning Outcomes: At the end of this unit, students should be able to

- Creating simple programs with PERL. (L4)
- Comparing CGI with other server-side technologies. (L5)

<u>TEXTBOOKS:</u>

1. "Programming the World Wide Web", Robert W Sebesta, Pearson Education, 7th Edition
2. "Web Technologies", Uttam K Roy, Oxford University Press
3. "The Web Warrior Guide to Web Programming", Bai, Ekedahl, Farrelll, Gosselin, Zak, Karparhi, Maclntyre, Morrissey, Cengage Learning

<u>REFERENCE BOOKS:</u>

1. "Ruby on Rails Up and Running, Lightning fast Web development", Bruce Tate, Curt Hibbs, Oreilly Media Inc., 2006

2. “Programming Perl”, Tom Christiansen, Jonathan Orwant, Oreilly Media Inc., 4th Edition, 2012
3. “Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX”, Black book, Dream Tech.
4. “An Introduction to Web Design, Programming”, Paul S Wang, Sanda S Katila, Cengage Learning.

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/html/
2. https://www.w3schools.com/js/
3. https://www.w3schools.com/xml/xml_whatis.asp
4. https://www.w3schools.com/php/

OPEN ELECTIVE – IV

Course Code	ENERGY CONSERVATION AND MANAGEMENT		L	T	P	C
21A020507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Familiarize present energy scenario, and energy auditing methods.
- Explain components of electrical systems, lighting systems and improvements in performance. Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
- Train on energy conservation in major utilities.
- Instruct principles of energy management and energy pricing.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain Energy Utilization and Energy Auditing Methods. **(K3)**
CO2: Analyse Electrical Systems Performance of Electric Motors and Lighting Systems. **(K4)**
CO3: Examine Energy Conservation Methods in Thermal Systems. **(K3)**
CO4: Estimate Efficiency of Major Utilities Such as Fans, Pumps, Compressed Air Systems, Havoc and D.G. Sets. **(K2)**
CO5: Elaborate Principles of Energy Management, Programs, Energy Demand and Energy Pricing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction: Energy – Power – Past & Present Scenario of World; National Energy Consumption Data – Environmental Aspects Associated with Energy Utilization –Energy Auditing: Need, Types, Methodology And Barriers. Role of Energy Managers, Instruments for energy auditing.

Learning Outcomes: At the end of this unit, students should be able to

- Infer energy consumption patterns and environmental aspects of energy utilization. (L4)
- Outline energy auditing requirements, tools, and methods. (L3)
- Identify the function of energy manager. (L2)

UNIT – II (9 Hrs)

Electrical Systems: Components of EB Billing – HT And LT Supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of Lighting, Efficacy, LED Lighting And Scope Of Economy In Illumination.

Learning Outcomes: At the end of this unit, students should be able to

- Outline components of electricity billing, transmission, and distribution. (L3)
- Analyse performance characteristics of transformers, capacitors, and electric motors. (L4)
- Examine power factor improvements, and electric motor efficiency. (L3)
- Evaluate lighting systems. (L4)

UNIT – III (9 Hrs)

Thermal Systems: Stoichiometry, Boilers, Furnaces, and Thermic Fluid Heaters – Efficiency Computation and Encon Measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, and Insulators & Refractory's.

Learning Outcomes: At the end of this unit, students should be able to

- Determine efficiency of boilers, furnaces, and other thermal systems. (L3)
- Recommend energy conservation measures in thermal systems. (L2)
- Justify steam systems in energy conservation. (L3)

UNIT – IV (9 Hrs)

Energy Conservation in Major Utilities: Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. Sets.

Learning Outcomes: At the end of this unit, students should be able to

- Explain energy conservation measures in major utilities. (L3)
- Apply performance test criteria for fans, pumps, compressors, havoc systems. (L3)
- Assess energy conservation in cooling towers and D.G. sets. (L3)

UNIT – V (9 Hrs)

Energy Management: Principles of Energy Management, Energy demand estimation, Organizing and Managing Energy Management Programs, Energy pricing.

Learning Outcomes: At the end of this unit, students should be able to

- Describe principles of energy management. (L2)
- Assess energy demand and forecast, organize energy management programs. (L3)
- Design elements of energy pricing. (L5)

TEXTBOOKS:

1. “Energy Manager Training Manual”, A Website Administered by Bureau of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government of India, 2004, 4 Volumes Available at ww.energymanagertraining.com

REFERENCE BOOKS:

1. “Industrial Energy Management and Utilisation”, Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988.
2. “Design and Management for Energy Conservation”, Callaghn, P.W., Pergamon Press, Oxford, 1981
3. “The Efficient Use of Energy”, Dryden. I.G.C., Butter worths, London, 1982
4. “Energy Management”, Murphy. W. R. and G. Mc Kay, Butter worths, London 1987

Course Code	BASICS OF POWER ELECTRONICS		L	T	P	C
21A020508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand the operation, characteristics, and usage of power semiconductor devices. **(K2)**
CO2: Understand different types of Rectifier circuits with different operating conditions. **(K2)**
CO3: Understand DC-DC converters operation and analysis of their characteristics. **(K2)**
CO4: Understand the construction and operation of voltage source inverters. **(K2)**
CO5: Apply all the above concepts to solve various numerical problem solving. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	1	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-	1	-

UNIT – I (9 Hrs)

Power Switching Devices: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

Learning Outcomes: At the end of this unit, students should be able to

- Know the V-I characteristics of different semi-conductor devices. (L4)
- Importance of drive circuit for MOSFET, IGBT and GTO. (L3)

UNIT – II (9 Hrs)

Rectifiers: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance.

Learning Outcomes: At the end of this unit, students should be able to

- Derivation of expressions of different configurations of rectifiers. (L3)
- Calculate the Average, R.M.S values of Voltages and Currents. (L4)

UNIT – III (8 Hrs)

DC-DC converters: Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of duty cycle. (L2)
- Analysis of waveforms at steady state of power circuit. (L4)
- Derivation of average output voltage of DC-DC converter. (L3)

UNIT – IV (9 Hrs)

Inverter: Single phase Voltage Source inverters– operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters –Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle operationally.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of pulse width modulation. (L2)
- Analysis of waveforms of single phase and three phase bridge inverters. (L4)

UNIT – V (10 Hrs)

AC voltage controllers & Cyclo converters: voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of TRIAC – TRIAC with R and RL loads– RMS load voltage, current and power actor-waveforms. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down Cyclo converters with Resistive load, Principle of operation, Waveforms, output voltage.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of the phase control and integral cycle control. (L2)
- Know the principal operation of voltage and frequency converter. (L4)
- Analysis waveforms of ac voltage converter and Cyclo converter. (L4)

TEXTBOOKS:

1. "Power Electronics: Circuits, Devices and Applications", M. H. Rashid, Prentice Hall of

India, 2nd Edition, 1998
2. “Power Electronics”, P. S. Bimbhra, Khanna Publishers, 4th Edition, 2010.
3. “Power Electronics”, M. D. Singh & K. B. Khanchandani, Tata Mc Graw Hill Publishing Company, 1998.

REFERENCE BOOKS:

1. “Power Electronics”, Ned Mohan, Wiley, 2011
2. “Fundamentals of Power Electronics”, Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004
3. “Power Electronics”, Vedam Subramanyam, New Age International (P) Limited, 1996.
4. “Power Electronics”, V. R. Murthy, Oxford University Press, 1st Edition, 2005.
5. “Power Electronics”, P. C. Sen, Tata Mc Graw-Hill Education, 1987
6. “Power Electronic Control of Alternating Current Motors”, J. M. D. Murphy.

Course Code	BASICS OF AUTOMOTIVE ENGINEERING		L	T	P	C
21A030507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:
- To introduce various components of an automobile and engine sub systems.
- To impart knowledge on various safety systems of an automobile and emission norms.

COURSE OUTCOMES:
After completion of the course, student will be able to

CO1: Describe the various components of an automobile and Working of fuel supply system. **(K2)**
CO2: Know the working of various lubrication and cooling systems. **(K1)**
CO3: Familiarize with the various systems such as ignition system and transmission system. **(K2)**
CO4: Explain the suspension, braking systems of an automobile and their differences. **(K2)**
CO5: Know about the emissions from engine and safety norms for the operation of an automobile. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)
Introduction: classification of automobiles, Components of four wheeler automobile- chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive
Fuel supply systems: simple fuel supply system in petrol and diesel engines. Working of simple Carburetor, direct fuel injection system in diesel engine.
Learning Outcomes: At the end of this unit, students should be able to
- Understand the parts of automobile engines. (L2)
- Understand the concept of fuel supply systems. (L2)

UNIT – II (7 Hrs)
Lubricating System: Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.
Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the function of Lubricating system. (L3)

UNIT – III (10 Hrs)

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, Electronic ignition system.

Transmission system: Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, Types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the concept of Ignition system and its types. (L2)
- Understand the concept of Transmission system. (L2)

UNIT – IV (10 Hrs)

Suspension System: Objectives of suspension system, front suspension system rigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the working of suspension system and its types. (L2)
- Analyze the different types of braking systems. (L3)

UNIT – V (9 Hrs)

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. Engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand emission concept in automobiles engines. (L2)
- Understand the concept of safety system. (L2)

TEXTBOOKS:

1. "Automobile Engineering Vol-1 & vol-2", Kirpal Singh, Standard Publishers Distributors, 11th Edition.
2. "Automotive Mechanics", William H Crouse & Donald LAnglin, Tata Mc Graw Hill Publications, 10th Edition.

3. "Automobile Engineering", Rajput, Laxmi Publications.

REFERENCE BOOKS:

1. "Automobile Engineering", R.B Gupta, Satya Prakashan Publications, 6th Edition.
2. "The Motor vehicle", Newton steeds & Garrett, Society of Automotive Engineers, 13th Edition.
3. "Automotive Engineering", G.B.S. Narang, Khanna Publishers, 5th Edition.
4. "Automotive Mechanics", Joseph Heitner, IPC Transport Press Ltd, 2nd Edition.
5. "The Automobile", Harbans Singh Reyat, S. Chand & company Pvt. Ltd., 6th Edition.

Course Code	BASICS OF TOTAL QUALITY MANAGEMENT		L	T	P	C
21A030508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concept of quality, cost of quality, international quality standards.
- To learn the principles of Total quality management, techniques for problem solving.
- To learn about various tools of quality management used in various industrial applications.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand the concepts of Quality and Quality Control Techniques. **(K2)**

CO2: Understand TQM concepts and History and able to use quality tools for problem solving. **(K2)**

CO3: Use TQM techniques and to formulate quality circles to find solutions with team work. **(K2)**

CO4: Apply various TQM Methods to solve problems in industry. **(K3)**

CO5: Analyze various quality problems and contribute towards continuous improvement in the system. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	2	-	2	2	2	-	2	-	-	-	2	-	-
CO5	1	-	-	-	-	2	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Inspection & Quality Control

Statistical Quality Control (SQC) – Techniques - variables and attributes Control charts : $\bar{X}$ - R Charts, P-Chart, C-Chart. Acceptance Sampling – Single and Double sampling Plan - OC Curves. BIS and ISO Standards – Importance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Control charts: $\bar{X}$ - R Charts, P-Chart, C-Chart, single and double sampling plans and BIS&ISO standards. (L1)

UNIT – II (8 Hrs)

TQM – concepts, History-Quality management philosophies-Juran, Deming, Crosby, Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – internal and external customers - TQM tools & techniques- 7 QC tools- 7 New QC tools.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various quality management philosophies, Evaluation of TQM, TQM tools and technologies. (L1)

UNIT – III (10 Hrs)

Problem solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis, Quality circles – organization – team approach.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse Problem solving process, system failure analysis, fault tree analysis, pedigree analysis and concept Quality circles. (L4)

UNIT – IV (10 Hrs)

Quality Function Development (QFD) – elements of QFD –benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Know the procedure for quality function development, bench marking, taguchi analysis. (L1)

UNIT – V (8 Hrs)

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management, Six sigma approach – application of six sigma approach to various industrial situations.

Learning Outcomes: At the end of this unit, students should be able to

- Know the value improvement, supplier teaming and the concept of business process re-engineering, supply chain management and six sigma. (L1)

TEXTBOOKS:

1. “Total Quality Management”, D.R.Kiran, BS Publications, 2016
2. “Total Quality Management”, Bester field, Pearson.

REFERENCE BOOKS:

1. “Quality management”, Howard Giltow, TMH
2. “Quality management”, Evans.
3. “Quality management”, Bedi

4. “Total Quality Management”, Joseph & Susan Berg
5. “Total Quality Management-Toward the Emerging Paradigm”, Bounds, Yorks, Adams, Ranney, McGraHill, 1994

Course Code	PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS		L	T	P	C
21A040507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyze cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand the concepts and operation of cellular systems. **(K2)**

CO2: Apply the concepts of co-channel interference & Cell splitting to solve engineering problems. **(K3)**

CO3: Compare different Handoffs. **(K4)**

CO4: Compare various types of multiple access techniques. **(K4)**

CO5: Evaluate suitability of a cellular system in real time applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	3

UNIT – I (10 Hrs)

Introduction to Cellular Mobile Systems: Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts and operation of cellular systems. (L2)
- Explain the characteristics of mobile radio environment. (L2)

UNIT – II (8 Hrs)

Cellular Radio System Design: General description of the problem, Concept of frequency reuse channels, Co-channel interference reduction, Desired C/I ratio, Cell splitting and sectoring, Microcell zone concept.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of frequency reuse and co-channel interference in cellular systems. (L2)
- Apply the concept of cellular systems to solve engineering problems. (L3)
- Explain the design problems of cellular systems. (L3)

UNIT – III (10 Hrs)

Handoffs and Dropped Calls: Why handoffs and types of handoffs, Initiation of handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Inter system handoff. Introduction to dropped call rate.

Learning Outcomes: At the end of this unit, students should be able to

- Understand why handoff is required. (L2)
- Apply handoff techniques to solve engineering problems. (L3)
- Compare various types of handoffs. (L4)

UNIT – IV (8 Hrs)

Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various types of multiple access techniques. (L2)
- Apply the concept of multiple access to solve engineering problems. (L3)
- Compare various types of multiple access techniques. (L4)

UNIT – V (9 Hrs)

Digital Cellular Systems: Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

Learning Outcomes: At the end of this unit, students should be able to

- Understand operation of various types of digital cellular systems. (L2)
- Compare various types of digital cellular systems. (L2)
- Evaluate suitability of a cellular system in real time applications. (L4)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Mobile Cellular Tele communications", William C.Y.Lee, McGraw – Hill International, 2nd Edition, 1995.
2. "Wireless Communications–Principles and Practice", Theodore S. Rappaport, PHI, 2nd Edition, 2004.

REFERENCE BOOKS:

1. "Principles of Modern Wireless Communications Systems –Theory and Practice", Aditya K. Jagannatham, McGraw – Hill International, 2015.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117102062
2. https://www.electronicshub.org/wireless-communication-introduction-types-applications/

Course Code	EMBEDDED SYSTEMS		L	T	P	C
21A040508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the basics of an embedded system
- To introduce the typical components of an embedded system
- To explain various communication interfaces used in embedded system
- To provide knowledge on the design process of embedded system applications

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Discuss the basic concepts of an embedded system. **(K3)**

CO2: Explainthe role of system core, memory, sensors, actuators, I/O and other sub system components in an embedded system. **(K3)**

CO3: Explain the different communication interfaces of an embedded system. **(K3)**

CO4: Illustrate about the interrupt service mechanism and device drivers. **(K3)**

CO5: Write aboutvarious steps involved in design and development of embedded firmware. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

Introduction to Embedded Systems: Definition, Embedded systems Vs General computing systems, History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

Learning Outcomes: At the end of this unit, students should be able to

- Classify embedded systems based on generation, complexity and performance. (L2)
- Discuss the characteristics of an embedded system. (L2)
- Explain the design process in embedded system. (L3)

UNIT – II (9 Hrs)

Typical Embedded System: Core of the embedded system, Memory-ROM, RAM, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer, PCB and passive components

Learning Outcomes: At the end of this unit, students should be able to

- Discuss about the core of the embedded system. (L2)
- Summarize different factors to be considered in the selection of memory for an embedded system. (L2)
- Explain the role of sensors, actuators, I/O components and other subsystem components used in embedded system. (L3)

UNIT – III (9 Hrs)

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various types of on-board communication interfaces. (L3)
- Describe the external communication interfaces used in embedded system. (L2)
- Discuss the different types of wireless communication interfaces used in embedded system. (L2)

UNIT – IV (9 Hrs)

Device drivers and Interrupt Service Mechanism: Programmed I/O busy-wait approach without interrupt service mechanism, Interrupt-driven I/O, interrupt service routine concept, interrupt sources, hardware interrupts, software interrupts, interrupt-servicing mechanism, multiple interrupts, interrupt service threads as second-level interrupt handlers, context and the periods for context switching, interrupt latency, interrupt-service deadline, interrupt service mechanism form context-saving angle, Device driver programming.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize pros and cons of interrupt driven data transfer. (L2)
- Illustrate hardware and software interrupts with examples. (L3)
- Know how interrupts can be used to minimize latency. (L3)
- Describe uses of hardware and software assigned priorities in an interrupt service mechanism. (L2)
- Differentiate ISRs & device driver functions. (L2)

UNIT – V (8 Hrs)

Embedded Firmware Design and Development: Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the different approaches for embedded firmware design. (L2)
- Discuss the different embedded firmware development languages. (L2)
- Explain the process of Assembly language to machine language conversion and High-level language to machine language conversion. (L3)
- Write aboutvarious steps involved in design and development of embedded firmware. (L3)

TEXTBOOKS:

1. "Introduction to Embedded Systems", Shibu. K.V., McGraw Hill Education, 2nd Edition, 2017.
2. "Embedded Systems: Architecture, Programming and Design", Raj Kamal, McGraw Hill Education, 3rd Edition, 2017

REFERENCE BOOKS:

1. "Computers as Components", Wayne Wolf, Morgan Kaufmann, Elsevier, 2nd Edition
2. "Embedded Systems- An integrated approach", Lyla B Das, Pearson education, 2012
3. "Embedded Microcomputer Systems Real Time Interfacing", Jonathan W.Valvano, Cengage Learning, 3rd Edition, 2012.

Course Code	CLOUD COMPUTING – AWS		L	T	P	C
21A050507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Define cloud services and models
- Demonstrate design the architecture for new cloud application.
- Explain how to re-architect the existing application for the cloud

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Apply the procedure for Cloud deployment. **(K3)**
CO2: Distinguish different cloud service models and deployment models. **(K3)**
CO3: Compare different cloud services. **(K4)**
CO4: Implementation of various services in cloud environment. **(K5)**
CO5: Design applications for an organization which use cloud environment. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	2	1	-	-	1	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-	2	2
CO4	3	-	2	-	-	-	-	-	3	-	-	-	-	2
CO5	3	-	2	-	-	-	-	-	3	-	-	-	-	2

UNIT – I (9 Hrs)

Introduction to Cloud Computing: Introduction to Cloud Computing, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the Cloud characteristics and models. (L2)
- Classify different models, different technologies in cloud. (L2)

UNIT – II (9 Hrs)

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and

Management Services, Identity and Access Management Services, Open Source Private Cloud Software, Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the Services and Platform of cloud. (L2)
- Demonstrate Hadoop Cluster Setup. (L2)

UNIT – III (9 Hrs)

Cloud Application Design: Design Considerations, Reference Architectures, Cloud Application Design Methodologies, Data Storage Approaches, Multimedia Cloud: Introduction, Case Study: Live Video Streaming App, Streaming Protocols, Case Study: Video Transcoding APP.

Learning Outcomes: At the end of this unit, students should be able to

- Design and build cloud applications. (L6)
- Describe the multimedia cloud. (L2)

UNIT – IV (10 Hrs)

Python for Amazon Web Services: Python for Amazon Web Services, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.

Learning Outcomes: At the end of this unit, students should be able to

- Select different cloud services from different vendors. (L2)
- Utilize Python language to access cloud services. (L3)

UNIT – V (8 Hrs)

Case Study: Various Web Applications - Cloud Application Development in Python, Design Approaches, Image Processing APP, Document Storage App, Social Media Analytics App, Cloud Application Benchmarking and Tuning, Cloud Security, Cloud Computing for Education.

Learning Outcomes: At the end of this unit, students should be able to

- Investigate different Cloud applications. (L4)
- Design cloud applications using Python. (L6)

TEXTBOOKS:

1. "Cloud Computing: A Hands-on Approach", Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

REFERENCE BOOKS:

1. "Azure in Action", Chris Hay, Brian Prince, Manning Publications [ISBN: 9781935182481], 2010.

2. "Introducing Windows Azure" Henry Li, Apress, 1st Edition [ISBN: 978-14302-2469- 3], 2009.

Course Code	BASICS OF CRYPTOGRAPHY & NETWORK SECURITY		L	T	P	C
21A050508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:
- Understand essential building blocks and basic concepts of cyber security
- Explore Web security and Network security
- Explain the measures for securing the networks and cloud
- Understand privacy principles and policies
- Describe the legal issues and ethics in computer security

COURSE OUTCOMES:
After completion of the course, student will be able to

CO1: Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection. **(K3)**

CO2: Assess the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure. **(K4)**

CO3: Identify the nature of secure software development and operating systems. **(K3)**

CO4: Demonstrate the role security management in cyber security defense. **(K2)**

CO5: Adapt the legal and social issues at play in developing solutions. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	2
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

Learning Outcomes: At the end of this unit, students should be able to
- Explain Vulnerabilities, threats and. Counter measures for computer security. (L2)
- Interpret the design of the malicious code. (L2)

UNIT – II (9 Hrs)

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Root kit.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the attacks on browser, Web and email. (L2)
- Explain the security aspects of Operating Systems. (L3)

UNIT – III (9 Hrs)

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management.

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network security threats and attacks. (L3)
- Design the Counter measures to defend the network security attacks. (L4)
- Analyze the security tools and techniques for Cloud computing. (L4)

UNIT – IV (9 Hrs)

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster

Learning Outcomes: At the end of this unit, students should be able to

- Interpret the need for Privacy and its impacts of Emerging Technologies. (L2)
- Explain how to handle incidents and deal with Disaster. (L2)

UNIT – V (8 Hrs)

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

Learning Outcomes: At the end of this unit, students should be able to

- Adapt legal issues and ethics in computer security. (L4)
- Elaborate on the Emerging topics. (L4)

TEXTBOOKS:

1. "Security in Computing", Charles P. Fleeger, Prentice Hall, 5th Edition, 2010.
2. "Applied Cryptography", Bruce Schneier, John Wiley & Sons, 2nd Edition,1996

REFERENCE BOOKS:

1. "Information Security: The Complete Reference", Mark Rhodes-Ousley, 2nd Edition,
2. "Information Security Management: Concepts and Practice", McGraw-Hill, 2013.
3. "Roadmap to Information Security for IT and Infosec Managers", Michael E. Whitman and Herbert J. Mattord, Boston, MA: Course Technology, 2011

ONLINE LEARNING RESOURCES:

1. https://www.geeksforgeeks.org/cryptography-and-network-security-principles
2. https://onlinecourses.nptel.ac.in/noc22_cs90/preview

HONOURS

Course Code	TRAFFIC ENGINEERING		L	T	P	C
21A01HN01			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand traffic, its properties, measurement, simulation and control.
- To understand traffic flow variables and their measurement. Survey methods and data analysis techniques required by traffic engineers are presented.
- To compute highway capacity & level of service
- To understand Parking analysis, traffic safety, traffic signal control, regulation and signal design
- To Detrimental effects of traffic on environment, Air and Noise pollution are discussed.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Analyse various traffic control measures and traffic flow **(K4)**
CO2: Describe the factors affecting highway capacity and level of service **(K2)**
CO3: Analyse parking data for designing parking facilities **(K4)**
CO4: Illustrate the preventive measures to avoid accidents by analyzing the traffic conditions at site **(K2)**
CO5: Describe various traffic control measures by using various methods. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	-	2	-	-	-	-	-	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	2	-	-	-	2	-	-	-	-	-	1	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	2	-	-	-	-	-	2	2

UNIT – I (10 Hrs)

Traffic Characteristics Measurement And Analysis: Basic Traffic Characteristics - Speed, Volume And Concentration. Relationship Between Flow, Speed And Concentration. Traffic Measurement And Analysis - Volume Studies - Objectives, Methods. Speed Studies – Objectives, Definition Of Spot Speed, Time Mean Speed And Space Mean Speed; Methods Of Conducting Speed Studies; Presentation Of Speed Study Data; Head Ways And Gaps; Critical Gap; Gap Acceptance Studies.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate the characteristics of road users and speed studies (L5)
- Discuss traffic characteristics and analyse the traffic data (L4)

UNIT – II (10 Hrs)

Highway Capacity And Level Of Service: Basic Definitions Related To Capacity; Level Of Service Concept; Factors Affecting Capacity And Level Of Service; Computation Of Capacity And Level Of Service For Two Lane Highways, Multilane Highways And Freeways. Numerical Exercises.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate the capacity and level of service on the streets of rural and urban area.. (K4)
- Explain various aspects of highway capacity (L2)

UNIT – III (10 Hrs)

Parking Analysis: Types Of Parking Facilities – On-Street Parking And Off-Street Parking Facilities; Parking Studies And Analysis- Parking Inventory Study, Parking Usage Study By Patrolling, Questionnaire Survey, Cordon Surveys; Evaluation Of Parking Parameters; Parking Accumulation, Parking Load, Parking Turnover, Parking Index, Parking Volume. Numerical Exercises.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the parking data (L4)
- Explain about different types of parking facilities. L4)

UNIT – IV (10 Hrs)

Traffic Safety: Accident Studies And Analysis; Causes Of Accidents - The Road, The Vehicle, The Road User And The Environment; Engineering, Enforcement And Education Measures For The Prevention Of Accidents. Accident Data Recording – Condition Diagram, Collision Diagram.

Learning Outcomes: At the end of this unit, students should be able to

- Create awareness about traffic rules and laws at selected loacation (L6)
- Discuss about the measures to reduce accidents (L2)

UNIT – V (10 Hrs)

Traffic Control, Regulation Signal Coordination: Traffic Signals –Types Of Signals; Principles Of Phasing; Timing Diagram; Design Of Isolated Traffic Signal By Webster Method, Warrants For Signalization. Optimum Cycle Time- Saturation Flow Rate – Corrections For Left And Right Turns – Numerical Exercises.

Signal Coordination: Signal Co-Ordination Methods, Simultaneous, Alternate, Simple Progression And Flexible Progression Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Explain traffic signs and road markings (L3)
- Justify the necessity of given traffic signal at intersection of a road(L6)

TEXTBOOKS:

1. “Traffic Engineering and Transportation Planning”, L.R. Kadiyali, Khanna Publishers.
2. “Principles of Highways Engineering and Traffic Analysis”, Fred Mannering & Walter Kilareski, John Wiley & Sons Publication
3. “Traffic Engineering - Theory & Practice”, Louis J. Pignataro, Prentice Hall Publication.

REFERENCE BOOKS:

1. “Transportation Engineering - An Introduction”, C. Jotin Khisty, Prentice Hall Publication.
2. “Fundamentals of Transportation Engineering”, C. S. Papacostas, Prentice Hall India.
3. I.T.E. Traffic Engineering Hand Book.

Course Code	REMOTE SENSING AND GLOBAL POSITIONING SYSTEMS		L	T	P	C
21A01HN02			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand Basic Principles and Developments In Remote Sensing
- To understand Pre-Processing and enhancement techniques for Remotely Sensed Data
- To understand about different types of filtering techniques and fundamentals of GPS

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the basic principles and properties of remote sensing technology. **(K1)**
CO2: Describe the preprocessing and enhancement techniques for remotely sensed data. **(K3)**
CO3: Develop various transforming operations in image mapping. **(K3)**
CO4: Explain various types of filters and filtering techniques. **(K3)**
CO5: Describe the basics of GPS and applications of GPS technology in highway alignment. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	1	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	1	-
CO5	3	3	-	-	-	-	-	-	-	-	-	1	1	-

UNIT – I (12 Hrs)

Remote Sensing Technology : Basic Principles – Introduction, Electromagnetic And Its Properties, Interaction With Earth Surface Materials, Recent Developments In Remote Sensing, Social And Legal Implications of Remote Sensing, Status Of Remote Sensing.

Remote Sensing. Platforms & Sensors - Introduction, Characteristics Of Imaging Remote Sensing Instruments, Satellite Remote Sensing System – A brief over view , other remote sensing satellites.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the basic principles of remote sensing. (L2)
- Explain about remote sensing instruments and remote sensing system. (L3)

UNIT – II (11 Hrs)

Pre-Processing And Enhancement Techniques For Remotely Sensed Data: Introduction, Cosmetic Operation; Geometric Connection And Registration, Atmospheric Correction.

Learning Outcomes: At the end of this unit, students should be able to

- Implement various enhancement techniques fir remotely sensed data. (L3)

UNIT – III (9 Hrs)

Enhancement Technique - Introduction, Human Visual System, Contrast Enhancement; Pseudo Color Enhancement.

Image Transforms: Introduction, Arithmetic Operations, Empirically Based Image Transforms, Principal Component Analysis , Multiple Discriminant Analysis Etc.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about enhancement techniques like contrast enhancement, pseudo color enhancement. (L4)
- Analyze image transforms by principal component analysis, multiple discriminant analysis etc. (L4)

UNIT – IV (8 Hrs)

Filtering Technique Classification: Low-Pass (Smoothing Filters) High Pass (Sharpening) Filters, Edge Detection, Frequency Domain Filters. Geometrical Basis, Classification, Unsupervised And Supervised Classification, Classification Accuracy.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the classifications of filtering techniques. (L3)

UNIT – V (10 Hrs)

G.P.S.: Introduction, Elements Of Satellite Surveying, Eglobal Positioning System, Gps Satellites, Adjustment Computations, Gps Observables, Application Of Gps Technology In Highway Alignment, Network Planning.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the elements of satellite surveying and global positioning system. (L3)
- Describe the basics of GPS and its applications in highway alignment. (L1)

TEXTBOOKS:

1. "Principles of Remote Sensing", Paul Jumani, ELBS, 1985.

REFERENCE BOOKS:

1. "GPS Satellite Surveys", Alfred Leick, Willey & Sons
2. "Computer Processing of Remotely sensed Images - An Introduction", Paul M. Mather, John Wiley & Sons 1989.

Course Code	PAVEMENT ANALYSIS AND DESIGN		L	T	P	C
21A01HN03			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- Engineering analysis of stresses and strains in `typical highway pavement structures due to loading from traffic and climate; characterization of paving materials; structural pavement design by IRC, and AASHTO for flexible and rigid pavement are discussed.
- Overlay design for Flexible and Rigid pavement is discussed

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the different types of pavements and functions of layers. **(K4)**
CO2: Analyze the stresses in a flexible pavement and rigid pavement. **(K4)**
CO3: Categorize the material specifications and characteristics. **(K4)**
CO4: Design of flexible and rigid pavements by using IRC methods. **(K6)**
CO5: Design of airfield pavement by using different methods. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	2	2	2
CO2	2	2	2	2	-	2	-	-	-	-	-	2	2	2
CO3	2	2	2	-	-	2	-	-	-	-	-	2	2	2
CO4	2	2	2	2	-	2	-	-	2	-	-	2	2	2
CO5	2	2	2	2	-	2	-	-	2	-	-	2	2	2

UNIT – I (10 Hrs)

Factors Affecting Pavement Design: Variables Considered In Pavement Design, Types Of Pavements, Functions Of Individual Layers, Classification Of Axle Types Of Rigid Chassis And Articulated Commercial Vehicles, Legal Axle And Gross Weights On Single And Multiple Units, Tire Pressure, Contact Pressure, EAL And ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane Distributions & Vehicle Damage Factors, Effect Of Transient & Moving Loads.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the various types of pavements. (L4)
- Explain the classification of vehicles based on type of axle. (L4)

UNIT – II (10 Hrs)

Stresses In flexible and Rigid Pavements: Stress Inducing Factors In Flexible And Rigid Pavements; Stress In Flexible Pavements: Visco-Elastic Theory And Assumptions, Layered

Systems Concepts, Stress Solutions For One, Two And Three Layered Systems, Fundamental Design Concepts;
Stresses In Rigid Pavements: Westergaard's Theory And Assumptions, Stresses Due To Curling, Stresses And Deflections Due To Loading, Frictional Stresses, Stresses In Dowel Bars & Tie Bars
Learning Outcomes: At the end of this unit, students should be able to

- Analyze the stresses in a flexible pavement using multi-layered elastic theory. (L4)
- Analyze the stresses induced in rigid pavement using westergaard's theory. (L4)

UNIT – III (10 Hrs)
Materials and Characteristics: CBR And Modulus Of Subgrade Reaction Of Soil, Mineral Aggregates – Blending Of Aggregates, Binders, Polymer And Rubber Modified Bitumen, Fibre Reinforced Concrete, Permanent Deformation Parameters And Other Properties, Effects And Methods Of Stabilization And Use Of Geo Synthetics, Non Destructing Testing.
Learning Outcomes: At the end of this unit, students should be able to

- Explain the various methods of stabilization and the use of Geosynthetics in pavements. (L6)
- Analyze principles of various laboratory methods to characterize mixes. (L4)

UNIT – IV (11 Hrs)
Design of Flexible and Rigid Pavements: Development Of Design Methods, Flexible Pavement Design Concepts, Asphalt Institute's Methods With HMA And Other Base Combinations, AASHTO, IRC Methods For Highways And Low Volume Roads, Design Of Rigid Pavements: Calibrated Mechanistic Design Process, PCA, AASHTO & IRC Specifications, Rigid Pavement Design For Low Volume Rural Roads And Highways. Design Of Overlays: Types & Design Of Overlays: IRC Methods Of Overlay Design, Importance Of Profile Correction Course.
Learning Outcomes: At the end of this unit, students should be able to

- Design the flexible and rigid pavements by using various methods. (L6)
- Design overlays by IRC methods. (L6)

UNIT – V (10 Hrs)
Airfield Pavement Design: Aircraft Configurations, Flexible Airport Pavements - IS Specifications And Design, Corps Of Engineers, FAA Methods, AI Methods. Rigid Airport Pavements – IS Specifications, PCA Method, Corps Of Engineers Method, FAA Method.
Learning Outcomes: At the end of this unit, students should be able to

- Design flexible airport pavements with IS specifications. (L6)
- Design the airfield pavement design by FAA methods and AI methods. (L6)

TEXTBOOKS:

1. "Design of Functional Pavements", Nai C. Yang, Mcgraw Hill Publications
2. "Concrete Pavements", AF Stock, Elsevier, Applied Science Publishers
3. "Pavement Analysis & Design", Yang H. Huang, Prentice Hall Inc.

REFERENCE BOOKS:

1. "Principles of Pavement Design", Yoder.J. & Witzorac Mathew, W. John Wiley & Sons Inc
2. "Pavement and Surfacings for Highway & Airports", Micheal Sargious, Applied Science Publishers Limited
3. IRC Codes for Flexible and Rigid Pavements Design

Course Code	ROAD SAFETY ENGINEERING		L	T	P	C
21A01HN04			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- Discusses the fundamentals causes of road accidents & some of the statistical methods to analyze the traffic safety.
- The accident investigation and risk management are dealt.
- Introduction of Road Safety as an integral part of Road Design is emphasized.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: To investigate and determine the collective factors and remedies of accident involved. **(K2)**
CO2: Describe the various statistical methods in traffic safety analysis. **(K2)**
CO3: Describe the characteristics of road users and road safety design elements. **(K2)**
CO4: Create awareness about the road signs and role of signs in traffic safety. **(K2)**
CO5: Understand the fundamental concepts of ITS and emerging ITS applications. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	1	-	-	-	-	-	2	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	1	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	1	2
CO4	3	3	2	-	-	-	1	-	-	-	-	-	2	1
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	1

UNIT – I (10 Hrs)

Accident Investigations and Risk Management: Collection Of Accident Data, Assessment Of Road Safety, Methods To Identify And Prioritize Hazardous Locations And Elements, Determine Possible Causes Of Crashes, Crash Reduction Capabilities And Countermeasures, Effectiveness Of Safety Design Features, Accident Reconstruction, Condition And Collision Diagram.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the causes of accident occurred on the given road section. (L4)
- Illustrate the preventive measures to avoid accidents on the given road section. (L3)

UNIT – II (10 Hrs)

Traffic Engineering Studies: Statistical Methods In Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons- Traffic Management Measures And Their Influence On Accident Prevention.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate the traffic management measures and their influence in accident prevention. (L4)
- Explain various types of statistical methods in traffic safety analysis. (L3)

UNIT – III (10 Hrs)

Road Safety in Transport Planning And Geometric Design: Vehicle And Human Characteristics, Road Design And Safety Elements, Redesigning Junctions, Cross Section Improvements, Traffic Control, Traffic Calming Measures, Road Safety Furniture

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the road safety in transport planning. (L4)
- Classify the vehicular characteristics and human characteristics in road safety. (L4)

UNIT – IV (10 Hrs)

Role of Signs and Markings in Safety: Types Of Signs – Design Specifications – Guidelines For Installation – Role Of Signs In Safety; Types Of Road Markings – Design Specifications – Role Of Road Markings In Safety.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about different types of traffic signs and road markings. (L3)
- Develop the road signs for given traffic situation with justification and draw the relevant road markings. (L3)

UNIT – V (10 Hrs)

Traffic Management Systems for Safety, Road Safety Audits And Tools For Safety Management Systems, Road Safety Audit Process, Road Safety Improvement Strategies, ITS And Safety.

Learning Outcomes: At the end of this unit, students should be able to

- Write the road safety audit reports and apply statistical analysis to road safety engineering. (L6)
- Explain about advanced traffic management systems and ITS and role of ITS. (L3)

TEXTBOOKS:

1. “Traffic Engineering and Transportation Planning”, L.R. Kadiyali, Khanna Publishers
2. “Fundamentals of Transportation Engineering”, C. S. Papacostas, Prentice Hall India.
3. Road Safety by NCHR

REFERENCE BOOKS:

1. “Transportation Engineering – An Introduction”, C. Jotin Khisty, B. Kent Lall
2. “Fundamentals of Traffic Engineering”, Richardo G Sigua

3. "Handbook of Road Safety Measures", 2nd Edition, Rune Elvik, Alena Hoye, TrulsVaa, Michael Sorenson

ELECTRICAL AND ELECTRONICS ENGINEERING
(For the batches admitted from the academic year 2021-22)

Vision

- To be recognized for producing meritorious electrical engineers with research proficiency and social commitment

Mission

- To impart quality education with practice-based learning in producing electrical engineers with ethical values.
- To encourage the faculty and students to acquire mastery in cutting edge technologies.
- To implement research activities with social commitment.

Institutional Objectives

- To create a conducive and competitive environment for students through curricular and extra-curricular activities.
- Promote the culture of research among the faculty.
- To promote synergetic alliances with premier Institutions, Industry, CSIR laboratories and various Government organizations for Collaborative Research Projects.
- To promote economic and social enrichment of the society through Skill Development programmes, Entrepreneurship, and extension activities.
- To introduce demand-driven new UG&PG academic programmes.
- To ensure a high degree of quality in terms of providing infrastructure, research ambience, faculty and staff development.

Core Values

- *Thirst for Quality Education:* The stake holders of the institute particularly management, employees and students of the institution have a consistent thirst for quality improvement of the processes and services in the institution.
- *Lifelong Learning:* In the fast-changing technological world, acquiring a special skill at one point of time will not be enough for ever long survival. Hence to flourish in the workplace and to bring in innovations in the ways of doing, employee, student as well as alumni must be continuous learners and tech savvy.
- *Diversity and Participation:* PBRVITS promotes the involvement of faculty, staff, and students from all social, economic, ethnics, cultural and religious

backgrounds to get the synergy of combining the diversified agents. The focus is on involving students to exhibit their talent in various curricular and co-curricular activities and strengthening alumni link to share their experiences to the students.

- *Academic Integrity and Accountability:* Management induces accountability in the employees for the career of the students and the academic leadership establishes a mentoring mechanism for realization of responsibilities of students towards their parents and in turn to the society.

ELECTRICAL AND ELECTRONICS ENGINEERING

(For the batches admitted from the academic year 2021-22)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept./Branch & Innovations

Semester I (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110101	Calculus and Special Functions	3	0	0	3	30	70	100
2	BS	21A110102	Mathematical Methods	3	0	0	3	30	70	100
3	ES	21A020301	Fundamentals of Electrical Circuits	3	0	0	3	30	70	100
4	ES	21A050302	C Programming & Data Structures	3	0	0	3	30	70	100
5	ES	21A030301	Engineering Drawing	1	0	4	3	30	70	100
6	ES	21A020302	Fundamentals of Electrical Circuits Lab	0	0	3	1.5	30	70	100
7	ES	21A050303	C Programming & Data Structures Lab	0	0	3	1.5	30	70	100
8	HSMC	21A110201	Communicative English Lab	0	0	2	1	30	70	100
Total							**19**			**800**

Semester II (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110103	Differential Equations & Vector Calculus	3	0	0	3	30	70	100
2	BS	21A110104	Applied Physics	3	0	0	3	30	70	100
3	BS	21A110105	Applied Chemistry	3	0	0	3	30	70	100
4	HSMC	21A110202	English for Professionals	2	0	0	2	30	70	100
5	ES	21A040301	Electronic Devices & Circuits	3	0	0	3	30	70	100
6	BS	21A110108A	Applied Physics Lab	0	0	3	1.5	30	70	100
7	BS	21A110108B	Applied Chemistry Lab	0	0	3	1.5	30	70	100
8	ES	21A050301	Engineering & IT Workshop Lab	0	0	3	1.5	30	70	100
9	ES	21A040302	Electronic Devices & Circuits Lab	0	0	3	1.5	30	70	100
10	MC	21A000001	Environmental Science	2	0	0	0	30	-	-
Total							**20**			**900**

Semester III (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110112	Complex Variable & Transforms	3	0	0	3	30	70	100
2	PC	21A020401	Electro Magnetic Fields	3	0	0	3	30	70	100
3	PC	21A020402	Electrical Circuit Analysis	3	0	0	3	30	70	100
4	PC	21A020403	Electrical Machines - I	3	0	0	3	30	70	100
5	ES	21A020307	Digital Electronic Circuits	3	0	0	3	30	70	100
6	PC	21A020404	Electrical Circuits & Simulation Lab	0	0	3	1.5	30	70	100
7	ES	21A020308	Digital Electronic Circuits Lab	0	0	3	1.5	30	70	100
8	PC	21A020405	Electrical Machines – I Lab	0	0	3	1.5	30	70	100
9	SC	21A050701	Python Programming	1	0	2	2	30	70	100
10	MC	21A000002	Constitution of India	2	0	0	0	30	-	-
Total							**21.5**			**900**

Semester IV (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	ES	21A030302	Engineering Mechanics	3	0	0	3	30	70	100
2	PC	21A020406	Analog Electronic Circuits	3	0	0	3	30	70	100
3	PC	21A020407	Electrical Machines – II	3	0	0	3	30	70	100
4	PC	21A020408	Control Systems Engineering	3	0	0	3	30	70	100
5	HSMC	21A110203	Managerial Economics & Financial Analysis	3	0	0	3	30	70	100
6	PC	21A020409	Electrical Machines – II Lab	0	0	3	1.5	30	70	100
7	PC	21A020410	Control Systems & Simulation Lab	0	0	3	1.5	30	70	100
8	PC	21A020411	Analog Electronics Circuits Lab	0	0	3	1.5	30	70	100
9	SC	21A020701	Electrical Engineering workshop - I	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship-I (Community Service Project) during semester break										

Semester V (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A020412	Power System Architecture	3	0	0	3	30	70	100
2	PC	21A020413	Power Electronics	3	0	0	3	30	70	100
3	PC	21A020414	Electrical Measurements	3	0	0	3	30	70	100
4	OE-I		**Open Elective - I**	3	0	0	3	30	70	100
5	PE-I	21A020415 21A020416 21A020417	**Professional Elective - I** a) Design of Photovoltaic Systems b) Programmable Logic Controller and Applications a) Neural Networks & Fuzzy Logic	3	0	0	3	30	70	100
6	PC	21A020418	Power Electronics Lab	0	0	3	1.5	30	70	100
7	PC	21A020419	Electrical Measurement Lab	0	0	3	1.5	30	70	100
8	SC	21A050708	Web Designing	1	0	2	2	30	70	100
9	MC	21A000003	Universal Human Values	3	0	0	3	30	70	100
10	PROJ	21A020601	Internship – I Evaluation	0	0	0	1.5	0	0	100
Total							**24.5**			**1000**

Semester VI (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A020420	Power Semiconductor Drives	3	0	0	3	30	70	100
2	PC	21A020421	Power System Analysis	3	0	0	3	30	70	100
3	PC	21A020422	Digital Computing Platforms	3	0	0	3	30	70	100
4	PE-II	21A020423 21A020424 21A020425	**Professional Elective – II** a) Power system operation & Control b) Modern Control Theory c) Introduction to Hybrid and Electric Vehicles	3	0	0	3	30	70	100
5	OE-II		**Open Elective - II**	3	0	0	3	30	70	100
6	PC	21A020426	Power Systems Lab	0	0	3	1.5	30	70	100
7	PC	21A020427	Digital Computing Platforms Lab	0	0	3	1.5	30	70	100
8	PC	21A020428	Power converters using MATLAB/SIMULINK Lab	0	0	3	1.5	30	70	100
9	MC	21A000004	Research Methodology	2	0	0	0	30	---	---
10	SC	21A050704	Amazon Web Services	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship – II (Industry) during semester break										

Semester VII (Fourth year)

S. No	Category	Course Code	Course Title	Hours per week L	T	P	Credits C	CIE	SEE	Total
1	PE-III	21A020429 21A020430 21A020431	**Professional Elective – III** a) Electrical Distribution Systems b) Power System Protection c) Switched Mode Power Converters	3	0	0	3	30	70	100
2	PE-IV	21A020432 21A020433 21A020434	**Professional Elective – IV** a) Electrical Machine Design b) Utilization of Electrical Energy c) Power Quality	3	0	0	3	30	70	100
3	PE-V	21A020435 21A020436 21A020437	**Professional Elective – V** a) Concepts of Digital Signal Processing b) Modern Power Electronics c) HVDC & FACTS	3	0	0	3	30	70	100
4	OE-III		**Open Elective – III**	3	0	0	3	30	70	100
5	OE-IV		**Open Elective – IV**	3	0	0	3	30	70	100
6	HSMC	21A110204	Management Science	3	0	0	3	30	70	100
7	SC	21A020702	IOT Applications In Electrical Engineering	1	0	2	2	100	0	100
8	PROJ	21A020602	Internship – II Evaluation	0	0	0	3	0	0	100
Total							**23**			**800**

Semester VIII (Fourth Year)

S. No	Category	Course Code	Course Title	Hours per week L	T	P	Credits C	CIE	SEE	Total
1	PROJ	21A020603	Full Internship & Major Project	-	-	12	10	110	140	250
2	PROJ	21A020604	Technical Seminar	-	-	4	2	50	-	50
Total							**12**			**300**

Open Elective – I

S. No	Course Code	Course Title
1	21A010501	Air Pollution and Control
2	21A030501	Robotics
3	21A030502	Basics of Mechanical Engineering
4	21A040501	Integrated Circuits and Applications
5	21A040502	Introduction to Signal Processing
6	21A050501	Operating Systems Concepts
7	21A050502	Computer Architecture & Organization

Open Elective – II

S. No	Course Code	Course Title
1	21A010502	Environmental Pollution and Control
2	21A030503	Automation in Industries
3	21A030504	Rapid Prototyping
4	21A040503	Principles of Communication Systems
5	21A040504	Electronic Instrumentation
6	21A050503	Java Programming
7	21A050504	Basics of Database Management Systems

Open Elective – III

S. No	Course Code	Course Title
1	21A010503	Disaster Management and Mitigation
2	21A030505	Optimization Techniques
3	21A030506	Global Warming and Climate Changes
4	21A040505	Electronic Sensors
5	21A040506	Introduction to Image Processing
6	21A050505	Introduction to Internet of Things
7	21A050506	Web Technologies for Beginners

Open Elective – IV

S. No	Course Code	Course Title
1	21A010504	Cost Effective Housing Techniques
2	21A030507	Basics of Automotive Engineering
3	21A030508	Basics of Total Quality Management
4	21A040507	Principles of Cellular and Mobile Communications
5	21A040508	Embedded Systems
6	21A050507	Cloud Computing – AWS
7	21A050508	Basics of Cryptography & Network Security

COURSES OFFERED FOR HONOURS DEGREE IN EEE

S. No	Course Code	Course Title	Hours per week		Credits	CIE	SEE	Total
			L	T	C			
1	21A02HN01	Advanced Power Semiconductor Devices	3	1	4	30	70	100
2	21A02HN02	Applications of Power Electronics to Power Systems	3	1	4	30	70	100
3	21A02HN03	Reactive Power Compensation and Management	3	1	4	30	70	100
4	21A02HN04	Energy Efficient Electrical Systems	3	1	4	30	70	100
5	21A02HN05	MOOC – 1	-	-	2	-	-	-
6	21A02HN06	MOOC – 2	-	-	2	-	-	-

LIST OF MINORS OFFERED TO EEE

S. No	Course Code	Course Title	Department offering the course
1	21A040402	Pulse and Digital Circuits	ECE
2	21A040415	Data Communication and Networking	ECE
3	21A040433	Biomedical Signal Processing	ECE
4	21A040434	Radar Engineering	ECE
5	21A050415	Design and Analysis of Algorithms	CSE & ALLIED
6	21A050418	Mobile Computing	CSE & ALLIED
7	21A310402	Artificial Intelligence and Neural Networks	CSE & ALLIED
8	21A350401	Sensors and Internet of Things	CSE & ALLIED

Course Code	CALCULUS AND SPECIAL FUNCTIONS (Common to all branches)		L	T	P	C
21A110101			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course will illuminate the students in the concepts of calculus and Mean value theorems.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Utilize mean value theorems to real life problems.

CO2: Familiarize with functions of several variables which is useful in optimization.

CO3: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems.

CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 3- dimensional coordinate systems.

CO5: Utilize special functions in evaluating definite integrals.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (10 Hrs)

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT – II (12 Hrs)

Multi variable calculus: Partial derivatives, total derivatives, chain rule, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes: At the end of this unit, students should be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

UNIT – III (10 Hrs)

Double Integrals: Evaluation of Double integrals, change of order of integration, change of variables. Areas using Double Integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

UNIT – IV (10 Hrs)

Triple Integrals: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volumes using triple integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate triple integrals in Cartesian, cylindrical and spherical polar coordinates. (L5)
- Apply triple integration techniques in evaluating volumes. (L4)

UNIT – V (12 Hrs)

Beta and Gamma functions: Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

TEXTBOOKS:

1. "Higher Engineering Mathematics", S. Grewal, Khanna Publishers, 44/e, 2017.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.

2. "Calculus", George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
3. "Advanced Modern Engineering Mathematics", Glyn James, Pearson publishers, 4/e, 2011.
4. "Advanced Engineering Mathematics", Michael Greenberg, Pearson Education, 9th Edition.
5. "Advanced Engineering Mathematics with MATLAB", Dean G. Duffy, CRC Press
6. "Advanced Engineering Mathematics", Peter O'Neil, Cengage Learning.
7. "Engineering Mathematics Volumes-I &II", R.L. Garg Nishu Gupta, Pearson Education
8. "Higher Engineering Mathematics", B. V. Ramana, McGraw Hill Education
9. "Higher Engineering Mathematics", H. K. Das, Er. Rajnish Verma, S. Chand & Co. Ltd.
10. "Advanced Engineering Mathematics", N. Bali, M. Goyal, C. Watkins, Infinity Science Press.
11. "Engineering Mathematics", T.K.V Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications.

Course Code	MATHEMATICAL METHODS (Common to all branches)		L	T	P	C
21A110102			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course aims at providing use of matrix algebra techniques for practical applications.
- This course aims at providing the student with the knowledge on Various numerical Methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop the use of matrix algebra techniques that is needed by engineers for practical applications.

CO2: Understand and solve the roots of equation using Bisection method, Iterative method, Regula-Falsi method, Newton Raphson method and solve the system of algebraic equations.

CO3: Apply concept of interpolation and derive interpolating polynomial using Newton's forward and backward formulae, Lagrange's formulae, Gauss forward and backward formulae.

CO4: Solving initial value problems to ordinary differential equations.

CO5: Determine the process of finding integral equations using Simson's 1/3, Simson's 3/8 Rule and Trapezoidal rule and fitting a best curve using least squares method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1	-

UNIT – I (10 Hrs)

Matrices: Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their Properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Diagonalization of a matrix.

Learning Outcomes: At the end of this unit, students should be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT - II (10 Hrs)

Solution of Algebraic & Transcendental Equations: Introduction-Bisection method-Iterative method-Regula-Falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan Method-Gauss Seidal method.

Learning outcomes: At the end of this unit, students should be able to

- Calculate the roots of equation using Bisection method and Iterative method. (L3)
- Calculate the roots of equation using Regula-Falsi method and Newton Raphson method. (L3)
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Seidal method. (L3)

UNIT - III (10 Hrs)

Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of interpolation. (L2)
- Derive interpolating polynomial using Newton's forward and backward formulae. (L3)
- Derive interpolating polynomial using Lagrange's formulae. (L3)
- Derive interpolating polynomial using Gauss forward and backward formulae. (L3)

UNIT - IV (12 Hrs)

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations- Euler's Method - Modified Euler's Method-Runge-Kutta Methods.

Learning Outcomes: At the end of this unit, students should be able to

- Solve initial value problems to ordinary differential equations using Taylor's method. (L3)
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods. (L3)

UNIT - V (12 Hrs)

Numerical Integration & Curve Fitting:

Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Fitting of straight line – second degree curve –Exponential curve –Power curve by the method of least squares.

Learning Outcomes: At the end of this unit, students should be able to

- Fit a best curve using method of least squares. (L3)
- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule. (L3)
- Solve integral equations using Trapezoidal rule. (L3)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna publishers.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India
3. "Introductory Methods of Numerical Analysis", S. S. Sastry, PHI publishers.

REFERENCE BOOKS:

1. "Higher Engineering Mathematics", B. V. Ramana, Mc Graw Hill publishers.
2. "Advanced Engineering Mathematics", Alan Jeffrey, Elsevier Publishers
3. "A Text Book of Engineering Mathematics Vol – I", T.K.V. Iyengar, B. Krishna Gandhi, S. Chand & Company.

Course Code	FUNDAMENTALS OF ELECTRICAL CIRCUITS (Common to EEE & ECE)		L	T	P	C
21A020301			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Basic characteristics of R, L, C parameters, their Voltage and Current Relations and Various combinations of these parameters
- The Single-Phase AC circuits and concepts of real power, reactive phasor, complex power, phase angle and phase difference
- Series and parallel resonances, bandwidth, current locus diagrams
- Network theorems and their applications
- Network Topology and concepts like Tree, Cut-set, Tie-set, Loop, Co-Tree

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the equivalent impedance by using network reduction techniques and determine the current through, voltage across and power through any element

CO2: Determine the Dual of the network; develop the Cut Set and Tie-set Matrices for a given Circuit. Also understand various basic definitions and concepts

CO3: Determine the real power, reactive power, power factor of a given excitation.

CO4: Apply the network theorems suitably

CO5: Analyze the three-phase circuits with star-delta transformation

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT - I (12 Hours)

Introduction to Electrical & Magnetic Circuits: Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage – Current Relationship for Passive Elements. Kirchhoff's Laws – Network Reduction Techniques- Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation and Examples

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits, MMF Calculations.

Learning Outcomes: At the end of this unit, students should be able to

- Know about Kirchhoff's Laws in solving series, parallel, non-series-parallel

configurations in DC networks (L2)
- Know about voltage source to current source and vice-versa transformation in their representation (L2)
- Understand Faraday's laws (L2)
- To distinguish analogy between electric and magnetic circuits (L2)
- To understand analysis of series and parallel magnetic circuits (L2)

UNIT- II (12 Hours)

Network Topology: Definitions – Graph – Tree, Basic Cut-set and Basic Tie-set Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis.

Learning Outcomes: At the end of this unit, students should be able to
- Understand basic graph theory definitions which are required for solving electrical circuits (L2)
- Understand about loop current method (L2)
- Understand about nodal analysis methods (L2)
- Understand about principle of duality and dual networks (L2)
- Identify the solution methodology in solving electrical circuits based on the topology (L2)

UNIT- III (12 Hours)

Single Phase A.C Circuits: R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation- Resonance - Phasor diagrams - Concept of Power Factor- Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples.

Learning Outcomes: At the end of this unit, students should be able to
- Understand fundamental definitions of 1-ϕ AC circuits (L2)
- Distinguish between scalar, vector and phasor quantities (L2)
- Understand voltage, current and power relationships in 1-ϕ AC circuits with basic elements R, L, and C. (L2)
- Understand the basic definitions of complex immittances and complex power (L2)
- Solve 1-ϕ AC circuits with series and parallel combinations of electrical circuit elements R, L and C. (L2)

UNIT- IV (12 Hours)

Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millmann's, Tellegen's, and Compensation Theorems for D.C and Sinusoidal Excitations.

Learning Outcomes: At the end of this unit, students should be able to

- Know that electrical circuits are 'heart' of electrical engineering subjects and network theorems are main part of it. (L2)
- Distinguish between various theorems and inter-relationship between various theorems (L2)
- Know about applications of certain theorems to DC circuit analysis (L2)
- Know about applications of certain theorems to AC network analysis (L2)
- Know about applications of certain theorems to both DC and AC network analysis (L2)

UNIT- V (12 Hours)

Three Phase A.C. Circuits: Introduction - Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits - Loop Method - Star Delta Transformation Technique – for balanced and unbalanced circuits - Measurement of Active and reactive Power – Advantages of Three Phase System.

Learning Outcomes: At the end of this unit, students should be able to

- Know about advantages of 3-ϕ circuits over 1-ϕ circuits (L2)
- Distinguish between balanced and unbalanced circuits (L2)
- Know about phasor relationships of voltage, current, power in star and delta connected balanced and unbalanced loads(L2)
- Know about measurement of active, reactive powers in balanced circuits (L2)
- Understand about analysis of unbalanced circuits and power calculations (L2)

TEXTBOOKS:

1. "Fundamentals of Electric Circuits", Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. "Engineering circuit analysis", William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.

REFERENCE BOOKS:

1. "Circuit Theory Analysis & Synthesis", A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018.
2. "Network Analysis", M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
3. "Electrical Engineering Fundamentals", V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
4. "Electric Circuits- Schaum's Series", Mc Graw Hill, 5th Edition, 2010.
5. "Electrical Circuit Theory and Technology", John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

Course Code	C-PROGRAMMING & DATA STRUCTURES		L	T	P	C
21A050302	(Common to all branches)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- Demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C using Arrays and Strings.
CO3: Modularize the problem and also solution.
CO4: Design applications in C using Functions, Pointers, and Structures.
CO5: Explore various operations on Stacks, Queues and Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT - I (15 Hrs)

Computer Fundamentals, Algorithm, Flowchart.

Introduction to C Language: Characteristics, Identifiers, Constants, Data types, Keywords, Basic input/output statements, Structure of a C program.

Operators and Expressions: Operators classification, Assignment Operator, Arithmetic Operators, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators with examples – Operator precedence and Associativity, Type casting.

Statements: Simple and Compound statements, Control Statements - Conditional/Decision statements, Loop Control Statements, Branch Control statements.

Learning Outcomes: At the end of this unit, students should be able to

- Solve complex problems using language independent notations (L3)
- Use C basic concepts to write simple C programs (L3)
- Test and execute the programs and correct syntax and logical errors (L4)
- Select the control structure for solving the problem (L4)
- Implement conditional branching, iterations (L2)

UNIT - II (12 Hrs)

Arrays: Declarations, Initialization and accessing elements, Single, Two and Multi-dimensional arrays.

Array Techniques: Array order reversal, finding the maximum and minimum number in a set, sorting the given array elements.

Strings: String I/O functions, String handling functions, Data conversion functions.

Learning Outcomes*:* At the end of this unit, students should be able to

- Use arrays to process multiple homogeneous data (L3)
- Solve mathematical problems using C Programming languages (L3)
- Apply string handling functions (L3)

UNIT - III (12 Hrs)

Functions: Types of functions, Library functions, User-defined functions, Function Categories, Nested functions, Recursion, Symbolic constants, Pre-processor Commands, Storage classes – auto, register, static, extern, Type qualifiers.

Input and output: Standard input and output, Non-formatted Input and Output statements, Formatted Input and Output statements.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand basic terminology of modular programming (L2)
- Apply modular approach for solving the problem (L3)
- Writing C programs using various storage classes to control variable access (L5)
- Apply input and output statements to process the data in various formats (L3)

UNIT - IV (12 Hrs)

Pointers: Pointers and addresses, Passing parameters to functions, Address Arithmetic operations, Void and Null pointers, Pointer and Arrays, Pointer and Strings, Array of Pointers, Pointer and Functions, Pointer-to-Pointer, Dynamic Memory Allocation. Uses of Pointers, Command line Arguments.

Structure and Union: Declaration and Initialization of a structure, Copy and comparisons, Array of structures, Structure with pointer, Nested structures, Type Definition, Enumeration, Union.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Structure the individual data elements to simplify the solutions (L6)
- Facilitate efficient memory utilization (L6)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT-V (14 Hrs)

Data Structures: Overview of data structures, **Stack:** Representation of a stack, Operations and Applications of a Stack – Evaluation of Arithmetic Expressions, Implementation of Recursion – **Queue:** Representation of a queue, Operations and Applications of a Queue – CPU Scheduling in Multi-programming Environment.

Linked List: Representations of linked lists, singly linked list, doubly linked list, Circular linked list and its operations.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Describe the operations of a stack (L2)
- Develop various operations on Queues (L6)
- Analyze various operations on singly linked list (L4)
- Interpret operations of doubly linked lists (L2)
- Apply various operations on Circular linked lists (L6)

TEXTBOOKS:

1. “The Complete Reference C”, Herbert Schildt, McGraw Hill Education, Fourth Edition
2. “Programming in C and Data Structures”, J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
3. “Fundamentals of Data Structures in C”, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition

REFERENCE BOOKS:

1. “The C Programming Language”, Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition
2. “C and Data Structures”, E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
3. “Programming in C”, Pradip Dey and Manas Ghosh, Oxford University Press, 2018.
4. “Schaum’s Outline of Data Structures”, Seymour Lipschutz, McGraw Hill, Revised First Edition.

Course Code	ENGINEERING DRAWING (Common to all branches)		L	T	P	C
21A030301			1	0	4	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.
- Instruct graphical representation of machine components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Construction of various conic curves, Cycloid curves
CO2: Construction of projections of Points, Lines applied in engineering
CO3: Construction of projections of Planes.
CO4: Construction of projection of solids development of surfaces regular Solids.
CO5: Representation of Ortho and Isometric views of solids.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO4	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO5	3	2	2	-	3	-	-	-	-	2	-	2	2	2

UNIT - I (12 Hrs)

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance - Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, Epi-cycloid and Hypocycloid - general method only.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of engineering drawing (L2)
- Know the conventions used in the engineering drawing (L1)
- Identify the curves obtained in different conic sections (L2)
- Draw different cycloidal curves. (L3)

UNIT– II (12 Hrs)

Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, true angle made by line.

Learning Outcomes: At the end of this unit, students should be able to

- Know how to draw the projections of points, lines (L1)
- Find the true length of the lines. (L2)

UNIT - III (18 Hrs)

Projection of planes: Projections of regular plane inclined to both the planes and also draw the projections of different planes in Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of planes. (L2)
- Draw the projection of plane inclined to one plane and both the planes. (L3)
- Understand the different commands used in Computerized drawing to draw different planes. (L2)

UNIT- IV (15 Hrs)

Projections of solids: Projections of regular solids inclined to one or both planes by rotational method.

Development of Solids: Development of lateral Surfaces of Right Regular Solids(without section)-Prism, Cylinder, Pyramid, Cone.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of solids. (L2)
- Draw the projection of solid inclined to one plane. (L3)
- Draw the projection of solids inclined to both the planes. (L3)

UNIT–V (18 Hrs)

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Conversion of Isometric Views to Orthographic Views. Drawing the Isometric views using Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the basics convectional representation of different projections (L1)
- Draw the Orthographic projection of simple solids. (L3)
- Draw the Isometric projection of simple solids. (L3)

TEXTBOOKS:

1. “Engineering Drawing”, K. L. Narayana & P. Kannaiah, SciTech Publishers, Chennai, 3/e.

2. "Engineering Drawing + AutoCAD", K. Venugopal, V. Prabhu Raja, New Age Publishers.
3. "Engineering Drawing", N. D. Bhatt, Charotar Publishers, 53/e, 2016

REFERENCE BOOKS:

1. "Engineering Drawing", Dhanajay A Jolhe, Tata McGraw-Hill, Copy Right, 2009.
2. "Engineering Drawing", Basant Agarwal & C. M. Agarwal, Tata McGraw-Hill
   "Engineering Drawing", Shah and Rana, Pearson Education, 2/e, 2009

Course Code	FUNDAMENTALS OF ELECTRICAL CIRCUITS LAB (Common to EEE & ECE)		L	T	P	C
21A020302			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To analyze the given network by applying mesh and nodal analysis
- Remember, understand and apply various theorems and verify practically.
- Understand and analyze active, reactive power measurements in three phase balanced circuits.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design and verify the various Kirchhoff's laws

CO2: Understand the electrical circuits by using mesh and nodal analysis

CO3: Remember, understand and apply various theorems and verify practically.

CO4: Understand and analyze active, reactive power measurements in three phase balanced circuits.

CO5: Determine the active, reactive power measurements in three phase balanced and unbalanced circuits

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	2	2	2	3	-	-	-	-	1	3	2
CO2	2	1	3	2	2	2	2	-	-	-	-	1	3	2
CO3	2	1	3	2	2	2	1	-	-	-	-	1	3	2
CO4	2	1	3	2	2	2	1	-	-	-	-	1	3	2
CO5	2	1	3	2	2	2	2	-	-	-	-	1	3	2

List of Experiments:

1. Verification of Kirchhoff's laws
2. Verification of Mesh and Nodal analysis
3. Verification of Thevenin's and Norton's Theorems
4. Verification of Superposition Theorem for average values
5. Maximum Power Transfer Theorem for DC circuits
6. Verification of Reciprocity, Millmann's Theorems for DC circuits
7. Determination of Self, Mutual Inductances and Coefficient of Coupling
8. Measurement of Active Power for Star Connected Balanced Loads
9. Measurement of Reactive Power for Star Connected Balanced Loads
10. Measurement of Active Power for Delta Connected Balanced Loads
11. Measurement of Reactive Power for Delta Connected Balanced Loads

Note: Any ten experiments should be performed from the above list of experiments

TEXTBOOKS:

1. "Fundamentals of Electric Circuits", Charles K. Alexander and Matthew. N. O. Sadiku, McGraw Hill, 5th Edition, 2013
2. "Engineering circuit analysis", William Hayt and Jack E. Kemmerly, McGraw Hill Company, 7th Edition, 2006

Course Code	C-PROGRAMMING & DATA STRUCTURES LAB (Common to all branches)		L	T	P	C
21A050303			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of C Programming
- To make the student solve problems, implement algorithms using C language
- To design programs using arrays, strings, pointers and structures
- To design Stack and Queue operations
- To apply different operations o linked lists

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Demonstrate the basic concepts of C programming language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs using functions, arrays, structures and pointers.
CO4: Illustrate the concepts Stacks and Queues.
CO5: Design operations on Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

Week 1

a) Write a C program to swap the given two integer values without using temporary variable.
b) Write a C program to print the first ‘N’ Fibonacci sequence numbers.

Week 2

a) Write a C program to print reverse of a given integer value.
b) Write a C program to find the roots of a quadratic equation.

Week 3

Write a C program that use recursive functions.

i) GCD of given two values.
ii) Factorial of a given value.

Week 4

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program to perform the following:

i) Addition of Two matrices   ii) Multiplication of Two matrices

Week 5

a) Write a C program that displays the position or index in the string S where the string T begins or -1 if S doesn't contain T.

b) Write a C program to read a set of strings and sort them in alphabetical order.

Week 6

a) Write a C program to count number of alphabets, digits and special symbols of a given line.

b) Write a C program to check whether a given string is palindrome or not.

Week 7

Write a C program to demonstrate the difference between call-by-value and call-by-address mechanisms.

Week 8

Write a program to perform the operations addition, subtraction, multiplication of complex numbers.

Week 9

Write a C program that implement stack operations using arrays.

Week 10

a) Write a C program that implement linear queue operations using arrays.

b) Write a C program that implement circular queue operations using arrays.

Week 11

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation   ii) Insertion   iii) Deletion   iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on doubly linked list.

i) Creation   ii) Insertion   iii) Deletion   iv) Traversal

Week 13

Write a C program that uses functions to perform the following operations on circular linked list.
i) Creation ii) Insertion iii) Deletion iv) Traversal

TEXTBOOKS:

1. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
2. "Computer Science: A Structured Programming Approach Using C", B.A. Forouzon and R.F. Gilberg, CENGAGE Learning, Third Edition, 2016.
3. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition,
2. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.

Course Code	COMMUNICATIVE ENGLISH LAB		L	T	P	C
21A110201	(Common to all branches)		0	0	2	1
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with special emphasis on Listening and Speaking skills.
- To equip students with professional skills & soft skills, Develop communication skills in formal and informal situations
- To help students present themselves confidently during Group Discussions and Oral Presentations

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use creativity in listening to formal and informal conversations.

CO2: Analyze the concepts of active listening and barriers to listening.

CO3: Communicate effectively in everyday life using right oral expressions.

CO4: Acquire the confidence to present themselves effectively during academic and professional presentations.

CO5: Acquire basic knowledge of non-verbal communication and its importance.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	3	-	-	-	-	-

UNIT - I (6 Hrs)

Essentials of Listening: Purpose of Listening, Listening to Conversation (Formal and Informal), Active Listening- an Effective Listening Skill, Barriers to Listening, Listening to Announcements- (railway/ bus stations/ airport /sports announcement/commentaries etc.)

Learning Outcomes: At the end of this unit, students should be able to

- Know the difference between hearing and listening. (L2)
- Understand the purpose of active listening. (L2)
- Follow the announcements through focused listening. (L2)

UNIT - II (6 Hrs)

Listening Comprehension: Academic Listening (Listening to Lectures), Listening to Short Talks and Listening to Presentations, Note Taking Tips

Learning Outcomes: At the end of this unit, students should be able to

- Comprehend different academic lectures. (L3)
- Take notes while listening to short talks and lectures. (L3)
- Improve comprehension skills through listening to short talks and presentations. (L3)

UNIT - III (6 Hrs)

Communicating in everyday life: Asking for and giving information, Offering and responding to offers, Requesting and responding to requests, Congratulating people on their success, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving,

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate expressions to communicate in everyday life. (L3)
- Communicate effectively in different contexts of conversations. (L3)
- Participate in role plays and situational dialogues with an exposure to social and professional contexts. (L3)

UNIT- IV (6 Hrs)

Presentation Skills: Giving Short Talks, Preparing power point presentation, Greeting and Introducing in presentations, Presenting a paper, Participating in group discussions (dos & don'ts)

Learning Outcomes: At the end of this unit, students should be able to

- Prepare a power point presentation effectively. (L3)
- Present a paper in a seminar. (L3)
- Participate in Group Discussions efficiently. (L3)

UNIT-V (6 Hrs)

Non-verbal Communication: Personal Appearance, Gestures, Postures, Facial Expression, Eye Contact, Body Language (Kinesics), Silence, Tips for Improving Non-Verbal Communication

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of body language in communication (L2)
- Improve non-verbal communication skills (L3)
- Understand how body language and non-verbal communication affects the personality of an individual in a social and professional set-up. (L2)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://learnenglish.britishcouncil.org/skills/listening
2. https://agendaweb.org/listening/comprehension-exercises.html
3. https://www.123listening.com/
4. https://www.linguahouse.com/learning-english/skill-4-learners/listening
5. https://www.talkenglish.com/listening/listen.aspx
6. https://ed.ted.co

Course Code	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to CE, EEE & ECE)		L	T	P	C
21A110103			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve the differential equations related to various engineering fields.
CO2: Apply a range of techniques to find solutions of standard PDEs.
CO3: Identify solution methods for partial differential equations that model physical Processes.
CO4: Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO5: Estimate the work done against a field, circulation and flux using vector calculus.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	3	-	-	-	-	-	-	-	1	-	-
CO5	2	3	2	2	-	-	-	-	-	-	-	1	-	-

UNIT – I (13 Hrs)

Linear differential equations of higher order (Constant Coefficients): Definitions, homogenous and non-homogenous, complimentary function, general solution, particularintegral, Wronskian method of variation of parameters. Simultaneous linear equations, Applications toL-C-R Circuit problems and Mass spring system.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the essential characteristics of linear differential equations with constant coefficients (L3)
- Solve the linear differential equations with constant coefficients by appropriate method (L3)
- Classify and interpret the solutions of linear differential equations (L3)
- Formulate and solve the higher order differential equation by analysing physical situations (L3)

UNIT– II (11 Hrs)

Partial Differential Equations: Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method.

Learning Outcomes: At the end of this unit, students should be able to

- Apply a range of techniques to find solutions of standard PDEs (L3)
- Outline the basic properties of standard PDEs (L2)

UNIT – III (12 Hrs)

Applications of Partial Differential Equations: Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation and Laplace's Equation.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the PDE (L3)
- Learn the applications of PDEs (L2)

UNIT– IV (13 Hrs)

Vector differentiation: Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes: At the end of this unit, the student will be able to

- Apply del to Scalar and vector point functions (L3)
- Illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

UNIT – V (14 Hrs)

Vector integration: Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stroke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Learning Outcomes: At the end of this unit, the student will be able to

- Find the work done in moving a particle along the path over a force field (L4)
- Evaluate the rates of fluid flow along and across curves (L4)
- Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

TEXTBOOKS:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.
2. "Higher Engineering Mathematics", B.S. Grewal, Khanna publishers, 44/e, 2017.

REFERENCE BOOKS:

1. "Engineering Mathematics", T. K. V Iyengar, Dr. B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications
2. "Advanced Engineering Mathematics", Michael Greenberg, Pearson, 2/e, 2018
3. "Calculus", George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
4. "Advanced Engineering Mathematics", R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.
5. "Advanced Modern Engineering Mathematics", Glyn James, Pearson publishers, 4/e, 2011.
6. "Advanced Engineering Mathematics", Michael Greenberg, Pearson edn, 9th Edition
7. "Advanced engineering mathematics with MATLAB", Dean G. Duffy, CRC Press
8. "Advanced Engineering Mathematics", Peter O'Neil, Cengage Learning.
9. "Engineering Mathematics Volumes-I &II", R.L. Garg Nishu Gupta, Pearson Education
10. "Higher Engineering Mathematics", B. V. Ramana, McGraw Hill Education.
11. "Higher Engineering Mathematics", H. K Das, Er. Rajnish Verma, S. Chand.
12. "Advanced Engineering Mathematics", N. Bali, M. Goyal, C. Watkins, Infinity Science Press.

Course Code	APPLIED PHYSICS (Common to EEE, ECE & CSE)		L	T	P	C
21A110104			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To identify the importance of the physical optics i.e., interference, diffraction and polarization related to its engineering applications
- To understand the mechanisms of lasers and propagation of light through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging microdevices.
- To present the basic concepts needed to understand the crystal structure of materials, X- ray diffraction and the importance of nano materials.
- Evolution of band theory to distinguish materials and explain the properties of semiconductors and superconductors.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the differences between interference, diffraction & polarization with applications.

CO2: Identify the importance of lasers and fiber optics in different engineering fields

CO3: Understand the response of dielectric & magnetic materials to the applied electric & magnetic fields

CO4: Explain the important properties of crystals & structure determination using X-ray diffraction along withthe nano materials.

CO5: Elaborate the physical properties of semiconductors and superconductors

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-

UNIT - I (13 Hrs)

Wave Optics Interference- Principle of superposition – Interference of light – Conditions for sustained interference - Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit – Grating spectrum.

Polarization- Introduction – Types of polarization – Polarization by double refraction- Nicol's Prism - Half wave and Quarter wave plates with applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the need of coherent sources and the conditions for sustained interference (L2)
- Identify engineering applications of interference (L3)
- Analyze the differences between interference and diffraction with applications (L4)
- Illustrate the concept of polarization of light and its applications (L2)
- Classify ordinary polarized light and extraordinary polarized light (L2)

UNIT - II (12 Hrs)

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Transmission of Signals in Step index and graded index fiber – Propagation Losses (qualitative) – Block diagram of Fiber Optics Communication System- Applications of Fibers in medical field.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

UNIT - III (12 Hrs)

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius- Mosotti relation in dielectrics (L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
- Explain the applications of dielectric and magnetic materials (L2)

UNIT - IV (12 Hrs)

Crystallography: Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Laue method - Powder method.

Nano materials – Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nano materials.

Learning Outcomes: At the end of this unit, students should be able to

- Classify various crystal systems (L2)
- Identify different planes in the crystal structure (L3)
- Analyze the crystalline structure by Bragg's law to measure the crystallinity of a solidby powder method (L4)
- Identify the nano size dependent properties of nanomaterials (L2)
- Illustrate the methods for the synthesis and characterization of nanomaterials (L2)
- Apply the basic properties of nanomaterials in various Engineering branches (L3)

UNIT- V (12 Hrs)

Semiconductors and Superconductors

Semiconductors- Origin of energy bands - Classification of solids into conductors, semiconductors and insulators -Intrinsic and extrinsic semiconductors (Qualitative treatment)– Density of carriers and Fermi levels in intrinsic & extrinsic semiconductors - Drift& diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) – High T_c superconductors – Applications of superconductors.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)
- Explain how electrical resistivity of solids changes with temperature (L2)
- Classify superconductors based on Meissner's effect (L2)
- Explain Meissner's effect, BCS theory & Josephson effect in superconductors (L2)

TEXTBOOKS:

1. "Engineering Physics", Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, S. Chand and Company

2. "Engineering Physics", B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. "Engineering Physics", K. Thyagarajan, McGraw Hill Publishers

REFERENCE BOOKS:

1. "Engineering Physics", Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. "Engineering Physics", Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
3. "Semiconductor physics and devices - Basic principles", Donald A, Neamen, McGraw Hill
4. "Engineering physics", P.K. Palanisamy, SCITECH Publications
5. "Applied Physics", S. Mani Naidu, Pearson Publications
6. "Lasers and Non-Linear Optics", B.B Laud, New Age International Publishers.

Course Code	APPLIED CHEMISTRY (Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110105			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize Applied chemistry and applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods and applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the salient features of different theories along with their applications.
CO2: Discuss about the model engineering materials.
CO3: Apply the knowledge of various electrodes for the development of new batteries.
CO4: Identify the different polymers and their uses in various fields of engineering.
CO5: Analyze the knowledge of different analytical techniques used in engineering and also development of new techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	-

UNIT - I (14 Hrs)

Structure and Bonding Models: Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, Molecular orbital theory –bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, π-molecular orbitals of butadiene and benzene, calculation of bond order. Crystal field theory–salient features–splitting in octahedral and tetrahedral geometry.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Discuss the basic concept of molecular orbital theory (L3)
- Explain the calculation of bond order of O_2 and CO molecules (L2)
- Discuss the salient features of Crystal field theory (L3)

UNIT - II (10 Hrs)

Modern Engineering Materials: Band theory of solids- band diagrams for conductors, Insulators, Semiconductors, Effect of doping on band structures.

Super conductors and Super capacitors: Introduction, Definition, Classification, Applications.

Nano chemistry: Introduction, classification of nano materials, properties and applications of Fullerenes, carbon nanotubes and Graphene nanoparticles.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nanotubes and Graphenes nanoparticles (L2).

UNIT - III (13 Hrs)

Electro Chemistry and Applications: Electrodes and their concepts, Types of Reference electrodes-their applications. Electrochemical cell, Nernst equation, Numerical problems on emf.

Primary cells – Zinc-air battery, Secondary cells – Lead-acid and Lithium-ion batteries-working of the batteries including cell reactions; Fuel cells- hydrogen-oxygen, methanol- oxygen fuel cells – working of the cells.

Potentiometry- principle, potentiometric titrations (redox titrations), Conductometry-conductometric titrations (acid-base titrations).

Electrochemical sensors– potentiometric sensors principle with examples, ampere metric sensors principle with examples and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)

UNIT - IV (13 Hrs)

Polymer Chemistry: Introduction to polymers, functionality of monomers and their significance, Tacticity of polymers, Types of polymerization- chain growth, step growth and copolymerization with specific examples and mechanisms of polymer formation.

Plastomers-Thermoplastics and Thermo setting plastics, Preparation, properties and applications of– PVC, Teflon, Bakelite, Nylons.

Elastomers – Buna-S, Buna-N– preparation, properties and applications of Buna-S, Buna-N.

Conducting polymers, examples, classification, polyacetylene, polyaniline - mechanism of conduction and applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylons (L2)
- Describe the mechanism of conduction in conducting polymers (L2)

- Discuss Buna-S and Buna-N and their applications (L2)

UNIT-V (10 Hrs)

Instrumental Methods and Applications: Introduction, Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law- Principle, instrumentation and applications of UV-Visible**,** IR-Spectroscopy's and pH-metry, Solid-Liquid Chromatography–TLC, retention factor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles and applications of different analytical instruments (L2)

TEXTBOOKS:

1. "Engineering Chemistry", Jain and Jain, Dhanpat Rai publications, 17/e, 2018
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014
3. "Principles of Instrumental Analysis", Skoog, FJ Holler and SR Crouch, 7/e, 2018
4. "Applied Chemistry", Guesser, Springer's Publications, 2001
5. "Atkins' Physical Chemistry", Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 10/e, 2010

REFERENCE BOOKS:

1. "Concise Inorganic Chemistry", J. D. Lee, Oxford University Press, 5/e, 2008
2. "Engineering Chemistry", G. V. Subba Reddy, K. N. Jayaveera and Ramachandraiah, McGraw Hill, 2020.

Course Code	ENGLISH FOR PROFESSIONALS		L	T	P	C
21A110202	(Common to all branches)		2	0	0	2
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To improve Reading and Writing proficiency of students in English with an emphasis on Vocabulary development.
- To provide knowledge of grammatical structures and encourage their appropriate use in writing.
- To improve students' comprehension skills required for academic and professional needs.
- To equip students with writing skills required for professional correspondence in different contexts.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate word knowledge and its usage in appropriate contexts.
CO2: Recognize and incorporate basic grammar mechanics and sentence variety in writing.
CO3: Improve comprehension skills through intensive and extensive reading practice.
CO4: Learn and apply various writing formats for effective communication.
CO5: Improve writing skills needed for professional correspondence in various contexts.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

UNIT - I (10 Hrs)

Vocabulary Building: Introduction to affixes and base words, Prefixes and suffixes, Basic comparing and contrasting, Idioms and Phrases, One word substitutes, Words often confused, Synonyms and Antonyms used in the everyday contexts, Using prior knowledge to determine the correct word for the context, Discovering the correct word in the sentence by looking at the surrounding words, Vocabulary in social interactions.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize word parts: affixes, prefixes, suffixes and base words. (L2)
- Use words appropriately in a context. (L3)
- Guess the meanings of the words by using the contextual clues. (L2)
- Use synonyms, antonyms, phrases and idioms in writing. (L2)

UNIT - II (10 Hrs)

Essentials of Sentence Formation: Basic Sentence Structure, word order, Subject-Verb Concord, Using Tenses, Punctuation Marks, Correction of Common Errors

Learning Outcomes: At the end of this unit, students should be able to

- Frame a sentence without any grammatical errors. (L3)
- Use appropriate punctuation marks. (L3)
- Identify common errors in a sentence. (L2)

UNIT - III (10 Hrs)

Reading Comprehension: Understanding short real-world notices, messages, factual material - Scanning, skimming - Inferring meaning - Critical reading - Reading and information transfer

Learning Outcomes: At the end of this unit, students should be able to

- Use skimming and scanning strategies while reading. (L3)
- Infer meaning from the given text. (L3)
- Distinguish between the main idea and supporting ideas. (L3)
- Critically analyse the given text. (L4)

UNIT - IV (10 Hrs)

Writing Skills: Rules for good writing and composition; Paragraph Writing: Structure of a paragraph, Types of paragraphs, Usage of Cohesive Devices; Essay writing: Structure of an Essay, Types of Essays; Letter Writing (Formal and informal): Format and Structure; and Email writing

Learning Outcomes: At the end of this unit, students should be able to

- Learn to organize thoughts into meaningful paragraphs. (L2)
- Use cohesive devices in making the piece of writing more coherent. (L3)
- Compose essays on different topics in a more organised structure. (L3)
- Draft letter and emails in a definite format. (L3)

UNIT-V (10 Hrs)

Professional Correspondence: Internal Correspondences – Memorandum, Note Taking, Minutes of Meetings; External Correspondences - Business Letters - Cover Letters - Sale Letters - Inquiry Letters - Complaint Letters - Emails & Netiquette

Learning Outcomes: At the end of this unit, students should be able to

- Draft official e-mails and letters for different professional purposes. (L3)
- Write proficiently memos and minutes of meeting. (L3)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://digital.library.upenn.edu/women/sultana/dream/dream.html
2. https://owl.purdue.edu/
3. https://www.thesaurus.com/
4. https://www.readwritethink.org/classroom-resources/student-interactives
5. https://www.fluentu.com/blog/english/english-writing-websites/

Course Code	ELECTRONIC DEVICES AND CIRCUITS (Common to EEE & ECE)		L	T	P	C
21A040301			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To introduce different types of semiconductor devices, viz., diodes and special diodes.
- To explain application of diodes as rectifiers, regulators, and voltage doubler.
- To describe operation and characteristics of Bipolar Junction Transistor& Field Effect transistors.
- To analyse the various biasing circuits using BJTs & FETs
- To analyse the BJT amplifiers using h parameter model.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Describe basic operation and characteristics of various PN junction diodes.

CO2: Analyze diode circuits for different applications such as rectifiers with and without filters, regulators, and voltage doubler.

CO3: Explain principle, operation, and applications of BJT, FET & MOSFET.

CO4: Design various biasing circuits for BJT, FET & MOSFET.

CO5: Analyze BJT amplifiers using h parameter model.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	2

UNIT - I (12 Hrs)

PN Junction Diode & Special Purpose Devices: Open circuited PN junction, operation, Current components in a PN diode, Diode Equation and its mathematical derivation, Volt-Ampere Characteristics, Energy band diagram of PN diode, Temperature dependence of Volt-Ampere Characteristics, Diode resistance (Static and Dynamic resistance), Diode capacitances (Transition and Diffusion capacitance).

V-I Characteristics of Zener diode, Avalanche breakdown and Zener breakdown. Principle of Operation, and Characteristics of Tunnel Diode, Varactor Diode, Schottky Barrier Diode, Silicon Control Rectifier & Uni-Junction Transistor (UJT), Semiconductor photo devices - LDR, LED, Photo diodes & Photo transistors.

Learning Outcomes: At the end of this unit, students should be able to

- Study the characteristics and operation of p-n junction diode and special diodes. (L1)

- Explain the energy band diagram & effect of temperature on the characteristics of diode. (L2)
- Derive the expression for transition capacitance and diffusion capacitance. (L2)

UNIT - II (10 Hrs)

Diode Applications: Diode as switch, Rectifier – Half wave and Full wave rectifier, Bridge rectifier, Ripple factor, PIV, Filters – Inductor and Capacitor Filter, L-section filter, pi-Filter, Zener as voltage regulator, Voltage doubler, Problem solving related to diode applications.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the circuit operation involving p-n junction and Zener diodes. (L2)
- Analyze the performance of rectifiers with and without filters. (L4)
- Design half wave and full wave rectifier circuits and voltage regulator. (L5)
- Compare the various rectifier circuits in terms of their parameter metrics. (L5)

UNIT - III (12 Hrs)

Transistor And FET Characteristics: Transistor construction, BJT Operation, BJT Symbol, Transistor as an Amplifier, Common Emitter, Common Base and Common Collector Configurations, Determination of h-Parameters from Transistor Characteristics, The Junction Field Effect Transistor (Construction, Principle of Operation, Symbol) - Pinch-Off Voltage – Volt-Ampere Characteristics, FET as Voltage Variable Resistor, Comparison between BJT and FET, MOSFET- Basic Concepts, Construction, modes(depletion & enhancement), symbol, principle of operation, characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Explain principle, operation, application of Bipolar Junction Transistor, FET and MOSFET. (L2)
- Describe input, output Characteristics of Bipolar Junction Transistor, FET and MOSFET. (L2)
- Analyze the different configurations (CB, CC, CE). (L4)

UNIT - IV (12 Hrs)

Biasing And Stabilization: Operating Point, DC and AC Load Lines, Importance of Biasing, Fixed Bias, Collector to Base Bias, Self-Bias, Bias Stability, Stabilization against Variations in I_{CO}, V_{BE} and β, Bias Compensation Using Diodes and Transistors, Thermal Runaway, Condition for Thermal Stability in CE configuration, Biasing of FET & MOSFET – self-bias, voltage divider bias, Illustrative problems.

Learning Outcomes: At the end of this unit, students should be able to

- Derive the expression for stability factor of various biasing circuits. (L3)
- Explain Thermal Stability and its condition. (L2)
- Design different biasing circuits of BJT, FET and MOSFET. (L5)

UNIT-V (14 Hrs)

Small Signal Analysis of BJT Amplifiers: BJT modelling using h-parameters, Analysis of CE, CB and CC configurations using h-Parameters, Comparison of CB, CE and CC configurations, Simplified Hybrid Model, Analysis of CE, CB and CC configurations using simplified Hybrid Model.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse different configurations of BJT using h parameter model. (L4)
- Compare CB, CE and CC configurations. (L4)

TEXTBOOKS:

1. "Electronic Devices and Circuits", J.Millman and Christos. C. Halkias, Satyabrata, TMH Third Edition, 2012.
2. "Electronic Devices and Circuits", K. Lalkishore, BSP, 2nd Edition, 2005

REFERENCE BOOKS:

1. "Electronic Devices and Circuits," R.L. Boylestad and Louis Nashelsky, 9th Edition, Pearson, 2006.
2. "Electronic Devices and Circuits", B.P.Singh and Rekha Singh, PEARSON, 2nd Edition, 2013.
3. "Electronic Devices and Circuits", David A. Bell, Oxford University press, 5th Edition, 2008.
4. "Electronic Devices and Circuits", N.Salivahanan and N. Suresh Kumar, TMH ,3rd Edition, 2012.

Course Code	APPLIED PHYSICS LAB		L	T	P	C
21A110108A	(Common to EEE, ECE & CSE)		0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity in semiconductors
- Will recognize the applications of laser in finding the wavelength in diffraction studies

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Operate optical instruments like microscope and spectrometer.
CO2: Determine thickness of a hair/paper with the concept of interference.
CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.
CO4: Evaluate the acceptance angle of an optical fiber and numerical aperture.
CO5: Determine the resistivity of the given semiconductor using four probe method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO2	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO3	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO4	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO5	3	2	-	-	-	-	-	-	1	1	-	-	-	-

LIST OF EXPERIMENTS

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of wavelength of LASER light using diffraction grating.
5. Determination of numerical aperture and acceptance angle of a given optical fiber.
6. Magnetic field along the axis of a circular coil carrying current–Stewart Gee's method.
7. Determination of the resistivity of semiconductor by Four probe method.
8. Determination of particle size using LASER.
9. Study the variation of B versus H by magnetizing the magnetic material. (B-H curve)
10. Determination of Dispersive power of prism.

REFERENCE BOOKS:

1. "A Textbook of Practical Physics", S. Balasubramanian, M.N. Srinivasan, S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Code	APPLIED CHEMISTRY LAB		L	T	P	C
21A110108B	(Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of Chemistry
- To verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Distinguish different types of titrations in the volumetric analysis
CO2: Determine the cell constant and conductance of solutions
CO3: Measure the strength of an acid present in secondary batteries
CO4: Analyze the effect of absorbance of given sample solution on concentration by using colorimetry.
CO5: Prepare advanced polymer Bakelite materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-		-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Preparation of Standard Oxalic acid solution
2. Determination of Strength of an acid in Lead- Acid battery
3. Estimation of Ferrous Iron by Dichrometry
4. Potentiometry - Determination of redox potentials and emfs
5. Conductometry - Determination of cell constant and conductance of solutions.
6. Conductometric titration of a) strong acid vs strong base b) weak acid vs strong base.
7. P^H-metric titration of a) strong acid vs strong base b) weak acid vs strong base.
8. Verification of the Beer-Lambert's Law and determination of strength of the given unknown solution.
9. Determination of the Retention factor of the sample by Thin Layer Chromatography (TLC).
10. Measurement of 10Dq by spectrophotometric method.
11. Preparation of Bakelite and measurement of its mechanical properties (strength)

12. Preparation of nanomaterials.

TEXTBOOKS:

1. “A Text Book on Experiments and Calculations in Engineering Chemistry”, S. Chand Publications, 9/e, 2003.
2. “Engineering Chemistry”, Shashi Chawla, Dhanpat Rai publications, 2/e, 2014.
3. “Experiments in Applied Chemistry”, Dr. Sunita Rattan, S. K. Kataria & Sons Publishers of Engineering, 2/e, 2004.

REFERENCE BOOKS:

1. “Vogel’s Text Book of Quantitative Chemical Analysis”, Mendham J et.al, Pearson Education, 6/e, 2012.

Course Code	ENGINEERING & IT WORKSHOP LAB		L	T	P	C
21A050301	(Common to all branches)		0	0	3	1.5
Pre-requisite	NIL	Semester	II			

PART-A (ENGINEERING WORKSHOP)

COURSE OBJECTIVES:

- To familiarize the students with wood working, sheet metal operations, fitting and electrical house, Wiring and foundry skills.
- To provide technical training to the students on Word, Excel and Presentation.
- To make the students know about the internal parts of a computer.
- To learn how to use Internet facility for Browsing and Searching.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply wood working skills and build different parts with metal sheets in real world applications.
CO2: Apply fitting operations in various applications and Preparation of moulds and castings.
CO3: Apply different types of basic electric circuit connections.
CO4: Prepare documentation, spread sheets for calculations and slides for Presentation.
CO5: Identify Computer peripherals and its functions, Internet browsing to obtain the required information

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	1	-
CO2	3	2	2	-	-	2	-	-	-	-	-	2	1	-
CO3	3	2	-	-	-	2	-	-	-	-	-	2	1	2
CO4	3	-	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

LIST OF TOPICS:

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint b) Dovetail joint or Bridle joint

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Square fit.

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting

Foundry:

a) Preparation of mould cavity using single piece pattern.
b) Preparation of mould cavity using split piece pattern

PART-B (IT WORKSHOP)

LIST OF TOPICS:

Task 1:

MS-Word: Students should be able to create documents using the word processor tool. Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit report.

Task 2:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 3:

Presentations: creating, opening, saving the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, running the slide show.

Task 4: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 5:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.

REFERENCE BOOKS:

1. "Workshop Practice Manual", K. Venkata Reddy, BS Publications.
2. "Engineering work shop practice for JNTU", V. Ramesh babu, VRB Publishers Pvt. Ltd., 2009.
3. "Work shop manual", P. Kannaiah, K. L. Narayana, SCITECH Publishers.
4. "Engineering practices lab manual", Jeyapoovan, Saravanapandian, Vikas Publishing House, 4/E
5. "Dictionary of mechanical engineering", GHF Nayler, Jaico Publishing House.
6. "Introduction to Computers", Peter Norton, McGraw Hill
7. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox.
8. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
9. "Networking your computers and devices", Rusen, Prentice Hall of India
10. "Bigelow's Trouble shooting, Maintaining & Repairing PCs", Bigelow, Tata McGraw Hill Edition

Course Code	**ELECTRONIC DEVICES & CIRCUITS LAB**		**L**	**T**	**P**	**C**
21A040302	(Common to EEE & ECE)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To verify the theoretical concepts practically from all the experiments.
- To analyze the characteristics of diodes, UJT, BJT, FET, SCR.
- To design voltage divider biasing of BJT and JFET.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the parameters of Diodes and Transistors from the characteristics.
CO2: Demonstrate the rectifier and voltage regulator circuits using diodes.
CO3: Analyze the Characteristics of UJT and SCR
CO4: Design biasing circuit of BJT and FET.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	3	2	-	2	2	2
CO2	3	3	-	-	-	-	-	-	3	2	-	3	3	2
CO3	3	3	2	2	-	-	-	-	3	2	-	3	3	2
CO4	3	3	3	2	-	-	-	-	3	2	-	3	2	2

LIST OF EXPERIMENTS:

1. P-N Junction Diode Characteristics
   - **Part A:** Germanium Diode (Forward bias & Reverse bias)
   - **Part B:** Silicon Diode (Forward bias only)
2. Zener Diode Characteristics
   - **Part A:** V-I Characteristics
   - **Part B:** Zener Diode act as a Voltage Regulator
3. Rectifiers (without and with c-filter)
   - **Part A:** Half-wave Rectifier
   - **Part B:** Full-wave Rectifier
4. BJT Characteristics (CE Configuration)
   - **Part A:** Input Characteristics
   - **Part B:** Output Characteristics.
5. BJT Characteristics (CB Configuration)
   - **Part A:** Input Characteristics
   - **Part B:** Output Characteristics

6. FET Characteristics (CS Configuration)
   Part A: Drain (Output) Characteristics
   Part B: Transfer Characteristics
7. SCR Characteristics
8. UJT Characteristics
9. Transistor Biasing
10. FET Biasing.

Tools / Equipment Required:
Licensed simulation software /DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs and all the required active devices.

Note: The students are required to design the circuit and they have to perform the analysis through simulator using Pspice/Equivalent Licensed simulation software tool. Further they are required to verify the result using necessary hardware in the hardware laboratory.

Course Code	ENVIRONMENTAL SCIENCE		L	T	P	C
21A000001	(Common to CE, ME, EEE, ECE, CSE, CSE-IOT)		2	0	0	0
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo- chemical cycles and ecological pyramids.

CO3: Understand various causes of pollution and solid waste management and related preventive measures.

CO4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5: Casus of population explosion, value education and welfare programmes.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO2	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO3	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO5	-	-	-	-	-	1	2	1	-	-	-	1	-	-

UNIT – I (10 Hrs)

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance, Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associatedproblems–Forestresources–Useandover–exploitation,deforestation,casestudies - Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of public awareness (L1)
- Know about the various resources (L1)

UNIT–II (10 Hrs)

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes: At the end of this unit, students should be able to

- Know about various echo systems and their characteristics (L1)
- Know about the biodiversity and its conservation (L1)

UNIT – III (10 Hrs)

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the various sources of pollution. (L1)
- Know about the various sources of solid waste and preventive measures. (L1)
- Know about the different types of disasters and their managerial measures. (L1)

UNIT- IV (10 Hrs)

Social Issues and The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, water shed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the social issues related to environment and their protection acts. (L1)
- Know about the various sources of conservation of natural resources. (L1)
- Know about the wild life protection and forest conservation acts. (L1)

UNIT – V (10 Hrs)

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the population explosion and family welfare programmes. (L1)
- Identify the natural assets and related case studies. (L1)

TEXTBOOKS:

1. "Text book of Environmental Studies for Undergraduate Courses", Erach Bharucha for University Grants Commission, Universities Press.
2. "Environmental Studies", Palani swamy, Pearson education
3. "Environmental Studies", S. Azeem Unnisa, Academic Publishing Company
4. "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", K. Raghavan Nambiar, SCITECH Publications (India), Pvt. Ltd.

REFERENCE BOOKS:

1. "Textbook of Environmental Science", Deeksha Dave and E. Sai Baba Reddy, Cengage Publications.

2. "Text book of Environmental Sciences and Technology", M. Anji Reddy, BS Publication.
3. "Comprehensive Environmental studies", J. P. Sharma, Laxmi publications.
4. "Environmental Sciences and Engineering", J. Glynn Henry and Gary W. Heinke, Prentice Hall of India Private limited
5. "A Text Book of Environmental Studies", G. R. Chatwal, Himalaya Publishing House
6. "Introduction to Environmental Engineering and Science", Gilbert M. Masters and Wendell P. Ela, Prentice Hall of India Private limited.

Course Code	COMPLEX VARIABLES & TRANSFORMS		L	T	P	C
21A110112	(Common to EEE & ECE)		3	0	0	3
Pre-requisite	Calculus and Special Functions, Differential Equations & Vector Calculus	Semester	III			

COURSE OBJECTIVES:

- This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables.
- To equip the students to solve various application problems in engineering through evaluation of continuous/discrete transforms.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand functions of Complex variable and its properties, and find derivatives of complex functions, analyticity of complex functions.

CO2: Apply Cauchy's integral theorem and Cauchy's integral formula, integration of complex functions using Residue theorem.

CO3: Analyze the concept Laplace and Inverse Laplace Transforms to solve Differential equations.

CO4: Determine the process of finding Fourier series expression of the given function, Fourier coefficients (Euler's) and expansion of Half range series.

CO5: Identify the applications of Fourier integrals, properties of Fourier Transforms. Analyze the concept of Z transforms and its properties.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	-
CO4	3	2	3	3	-	-	-	-	-	-	-	2	3	-
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	-

UNIT – I (12 Hrs)

Complex Variable – Differentiation: Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method - Conformal mappings-standard and special transformations (sin z, e^z, cos z, z^2) Mobius transformations (bilinear) and their properties.

Learning outcomes: At the end of this unit, students should be able to

- Understand functions of Complex variable and its properties. (L2)
- Find derivatives of complex functions. (L3)
- Understand the analyticity of complex functions. (L2)

- Understand the conformal mappings of complex functions (L2)

UNIT- II (12 Hrs)

Complex Variable – Integration: Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof); power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

Learning outcomes: At the end of this unit, students should be able to

- Understand the integration of complex functions. (L2)
- Apply Cauchy's integral theorem and Cauchy's integral formula. (L3)
- Understand singularities of complex functions. (L2)
- Evaluate improper integrals of complex functions using Residue theorem. (L4)

UNIT – III (12 Hrs)

Laplace Transforms: Definition-Laplace transform –Inverse Laplace Transform - standard functions - existence of Laplace Transform -shifting theorem's- Transforms of derivatives and integrals - Laplace transform of periodic function (without proof) - Unit step function - Dirac's delta function. –Convolution theorem – Differentiation and Integration of Transform- Solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Laplace transforms and Inverse Laplace transforms of Elementary functions. (L2)
- Understand Laplace transforms of special functions (Unit step function, Unit Impulse & Periodic). (L2)
- Apply Laplace transforms to solve Differential Equations (L4)

UNIT – IV (11 Hrs)

Fourier Series: Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms -Parseval's formula- Complex form of Fourier series.

Learning outcomes: At the end of this unit, students should be able to

- Understand finding Fourier series expression of the given function. (L2)
- Determine Fourier coefficients (Euler's) and identify existence of Fourier series of the given function. (L3)
- Expand the given function in Fourier series given in Half range interval. (L2)
- Apply Fourier series to establish Identities among Euler coefficients. (L3)

UNIT – V (10 Hrs)

Fourier Transforms & Z Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem.

Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by Z-transforms.

Learning outcomes: At the end of this unit, students should be able to

- Find Fourier Sine and cosine integrals. (L3)
- Understand Fourier and Z transforms. (L2)
- Apply properties of Fourier and Z transforms (L3)
- Apply Z transforms to solve difference equations. (L3)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna publishers.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India

REFERENCE BOOKS:

1. "Higher Engineering Mathematics", B. V. Ramana, Mc Graw Hill publishers.
2. "Advanced Engineering Mathematics", Alan Jeffrey, Elsevier.
3. "An Introduction to Ordinary Differential Equations", E. A. Coddington, Prentice Hall India, 1995.
4. "A text book of Engineering Mathematics", N.P. Bali and Manish Goyal, Laxmi Publications, 2008.

Course Code	ELECTRO MAGNETIC FIELDS		L	T	P	C
21A020401			3	0	0	3
Pre-requisite	Calculus and Special Functions	Semester	III			

COURSE OBJECTIVES:

- To understand the basic principles of electrostatics.
- To understand the basic principles of magneto statics for time invariant and time
- varying fields
- To understand the principles of dielectrics, conductors and magnetic potentials.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concept of electrostatics

CO2: Understand the concepts of Conductors and Dielectrics

CO3: Understand the fundamental laws related to Magneto Statics

CO4: Understand the concepts of Magnetic Potential and Magnetic force

CO5: Understand the concepts of Time varying Fields

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	3	2	-	2	3	2
CO2	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO3	3	3	2	1	1	-	-	-	3	2	-	3	3	2
CO4	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO5	3	2	1	1	1	1	-	-	-	-	-	-	3	2

UNIT–I (10 Hrs)

Electrostatics: Electrostatics: Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) due to Line, Surface and Volume Charges-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss's Law-Application of Gauss's Law-Maxwell's First Law- Numeric Problems. Laplace's Equation and Poisson's Equations - Solution of Laplace's Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field.

Learning Outcomes: At the end of this unit, students should be able to

- Determine electric field and potentials using Coulomb's law & Gauss law. (L3)
- Analyze Potential differences for different configurations. (L4)
- Classify static electric magnetic fields in different engineering situations. (L2)
- Determine the Concepts of Electric dipole, Electrostatic Energy and Energy density. (L3)

UNIT–II (10 Hrs)

Conductors And Dielectrics: Behavior of Conductors in an Electric Field-Conductors and Insulators – Polarization – Dielectric Conductors and Dielectric Boundary Conditions. Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field. Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the Concepts of Conduction and Convection currents. (L4)
- Understand the concept of capacitance for parallel plates, spherical & co-axial capacitors. (L3)
- Calculate Energy stored and energy density in a static electric field. (L3)

UNIT–III (10 Hrs)

Magneto Statics: Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular &Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current. Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems.

Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance- Numerical Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the Concepts of Magnetic field intensity using Biot-Savart Law & Ampere Law. (L4)
- Understand Maxwell's equations. (L2)
- Develop MFI due to an infinite sheet of current and a long filament carrying conductor in Different loops. (L3)

UNIT–IV (10 Hrs)

Magnetic Potential & Magnetic Force: Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations. Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors

Learning Outcomes: At the end of this unit, students should be able to

- Understand scalar magnetic potential and vector magnetic potential and its applications. (L3)
- Calculate the magnetic forces and torque produced by currents in Magnetic Field. (L2)
- Calculate self and mutual Inductances. (L4)
- Analyze the Concepts of Magnetic boundary conditions & Energy stored in the Magnetic

field. (L4)

UNIT–V (10 Hrs)

Time Varying Fields: Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current. Wave Equations - Velocity, Wave Length, Intrinsic Impedance and Skin Depth – Poynting Theorem – Poynting Vector and its Significance.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire knowledge on time varying fields & Faraday's law for Electromagnetic induction (L3)
- Analyze the Concepts Maxwell's Equations in Different Forms. (L4)
- Understand the Concepts Calculation of Poynting vector & Theorem. (L3)
- Analyze the Concepts of Wave Theory (L4)

TEXTBOOKS:

1. "Engineering Electromagnetics", William. H. Hayt, McGraw Hill, 2010.
2. "Principles of Electromagnetics", Sadiku, Kulkarni, OXFORD University Press, 6th Edition, 2015.

REFERENCE BOOKS:

1. "Field Theory", K. A. Gangadhar, Khanna Publications, 2003.
2. "Electromagnetics", J. D. Kraus, McGraw – Hill Inc, 5th Edition, 1999.
3. "Electromagnetics", Joseph Edminister, Tata Mc Graw Hill, 2006.

Course Code	ELECTRICAL CIRCUIT ANALYSIS		L	T	P	C
21A020402			3	0	0	3
Pre-requisite	Fundamentals of Electrical Circuits	Semester	III			

COURSE OBJECTIVES:

- To know the analysis of the series and parallel resonance circuits.
- Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C.
- To study the network parameters for given two port networks
- To know the applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources.
- Design symmetrical and unsymmetrical passive the filters.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the various locus diagrams and Resonance circuits

CO2: Calculate the various two-port network parameters

CO3: Calculate the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.

CO4: Applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources are known.

CO5: Design the filters, equalizers and PSPICE programs for Circuit Analysis.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	3	2	-	2	3	2
CO2	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO3	3	3	2	1	1	-	-	-	3	2	-	3	3	2
CO4	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO5	3	2	1	1	1	1	-	-	-	-	-	-	3	2

UNIT – I (12 Hrs)

Locus Diagrams & Resonance: Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters - Resonance-Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about basic concepts of Locus diagrams with different parameter variations of Electrical circuit elements (L2)
- Learn about occurrence of resonance with the presence of electrical circuit elements under certain operating conditions(L2)

UNIT – II (12 Hrs)

Two Port Networks: Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and inverse hybrid parameters, relationship between parameters, interconnection of two port networks. Series and Parallel connection of two port networks.

Learning Outcomes: At the end of this unit, students should be able to

- Understand and estimate the network parameters of T & π configurations of DC circuits or resistive elements(L2)
- Understand how Laplace transforms studied in mathematics courses, can be applied to identify energy storage elements in electrical circuits(L3)

UNIT – III (12 Hrs)

Transient Analysis: D.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions in network - Initial Conditions in elements - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in DC excitations (L3)
- Distinguish between classical method and Laplace transform approach in analysing transient phenomenon in sinusoidal excitations (L4)

UNIT – IV (12 Hrs)

Fourier Series & Fourier Transforms: Fourier Theorem - Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry - Line Spectra and Phase Angle Spectra - Analysis of Electrical Circuits to Non-Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Fourier transforms studied in Mathematics to Electrical circuits for non-sinusoidal periodic and non-periodic input waves (L4)
- Understand properties of Fourier series and Transforms (L2)

UNIT – V (12 Hrs)

Filter Design: Introduction, the Neper & decibel, Characteristic Impedance of symmetrical networks, the propagation constant, Properties of symmetrical networks, Filter fundamentals; pass and stop bands, Behavior of characteristic impedance, The constant – k low pass filter, the constant – k high pass filter.

Learning Outcomes: At the end of this unit, students should be able to

- Understand about what is a Filter, Classification, where they can be used, etc. (L2)
- Understand about attenuators and equalizers used in electronic high frequency circuit(L2)

TEXTBOOKS:

1. "Engineering Circuit Analysis", William Hayt, Jack E. Kemmerly and Jamie Phillips, McGraw Hill, 9th Edition, 2019.
2. "Fundamentals of Electric Circuits", Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.

REFERENCE BOOKS:

1. "Circuit Theory: Analysis & Synthesis", A. Chakrabarti, Dhanpat Rai & Sons, 2008
2. "Electrical Engineering Fundamentals", V. Del Toro, Prentice Hall International, 2009.
3. "Circuits and Networks: Analysis and Synthesis", A Sudhakar and Shyam Mohan SP, TMH, 5th Edition, 2015
4. "Electric Circuits" Mahamood Nahvi and Joseph Edminister, Schaum's Series, 6th Edition, 2013.
5. "Network Analysis", M.E. Van Valkenberg, Prentice Hall (India), 3rd Edition, 1980

Course Code	ELECTRICAL MACHINES - I		L	T	P	C
21A020403			3	0	0	3
Pre-requisite	Fundamentals of Electrical Circuits	Semester	III			

COURSE OBJECTIVES:

- Study magnetic materials, electromechanical energy conversions, principle and operation of DC machines and transformers and starters.
- understand the constructional details of DC machines and Transformers
- Analyze the performance characteristics of DC machines and transformer
- Evaluate efficiency, regulation and load sharing of DC machines and transformers
- Design Equivalent circuit of transformer

COURSE OUTCOMES:

After completion of the course the student will be able to

CO1: Able Understand the concepts of magnetic circuits, principle and operations of DC machines, starters and single and three phase transformers.

CO2: Able to understand the construction, operation and armature windings of a DC generator and also able to analyze the characteristics of DC generators

CO3: Evaluate generated emf, back emf, speed, efficiency and regulations of DC machines

CO4: Analyze single phase transformer operation and characteristics.

CO5: Analyze three phase transformer operation and characteristics.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	1	-	-	-	-	-	-	3	2
CO2	3	3	2	2	1	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	1	-	-	-	-	-	-	-	3	2
CO4	3	3	2	2	1	-	-	-	-	-	-	-	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	3	2

UNIT–I (12 Hrs)

Magnetic Material Properties and Applications:

Introduction, Magnetic materials and their properties, magnetically induced emf and force, AC operation of magnetic circuits, hysteresis and eddy current losses, permanent magnets, and applications of permanent magnet materials.

Principles of electromechanical energy conversion:

Energy in magnetic system, field energy and mechanical force, multiply-excited magnetic field systems, forces/torques in systems with permanent magnets, energy conversion via electric field, dynamical equations of electro mechanical systems

Learning Outcomes: At the end of this unit, students should be able to

- Understand the electromechanical energy conversion system (L2)
- Understand various magnetic materials, properties and Applications (L2)

UNIT–II (12 Hrs)

DC Generators: Constructional details of DC machine, principle of operation of DC generator, armature windings and its types, emf equation, armature reaction, effect of brush lead, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation, emf induced in a coil undergoing commutation, methods of improving commutation, OCC and load characteristics of different types of generators.

Parallel operation of DC Generators: DC shunt and series generators in parallel, equalizing connections

Learning Outcomes: At the end of this unit, students should be able to

- Understand the construction, operation and armature windings of a DC generator(L2)
- Analyze the characteristics of DC generators (L4)

UNIT–III (12 Hrs)

DC Motors: Force on conductor carrying current, back emf, Torque and power developed by armature, speed control of DC motors (Armature control and Flux control methods), Necessity of starters, constructional details of 3-point and 4-point starters, characteristics of DC motors, Losses in DC machines, condition for maximum efficiency

Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test, Fields test, Retardation test.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze speed control of DC motors, testing methods and parallel operation of DC machines (L4)
- Analyze the characteristics of DC motors (L4)

UNIT–IV (12 Hrs)

Single Phase Transformers: Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagrams (no load and on load), Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, losses and efficiency Testing - open circuit and short circuit tests, voltage regulation, Sumpner's test, separation of hysteresis and eddy current losses. Parallel operation of single-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the construction, operation and parallel operation of transformer (L2)
- Predetermine the efficiency and regulation of a transformer (L4)

UNIT–V (12 Hrs)

Three Phase Transformers: Three-phase transformer – construction, types of connection and their comparative features, Phase conversion - Scott connection, Tap-changing transformers - No-load and on-load tap- changing of transformers, Three-winding transformers- Cooling of transformers

Learning Outcomes: At the end of this unit, students should be able to

- Understand and analyze the phase conversions (L3)
- Analyze the tap changing of transformers (L4)

TEXTBOOKS:

1. "Electric Machines", I. J. Nagrath & D. P. Kothari, Tata Mc Graw – Hill Publishers, 3rd Edition, 2004.
2. "Electrical Machines" – P.S. Bimbhra, Khanna Publishers, 2011.

REFERENCE BOOKS:

1. "Performance and Design of D.C Machines", Clayton & Hancock, BPB Publishers, 2004.
2. "Electrical Machines", S.K. Battacharya, TMH Edn Pvt. Ltd., 3rd Edition, 2009.
3. "Electric Machinary", A. E. Fitzgerald, C. Kingsley and S. Umans, McGraw-Hill Companies, 5th Edition, 2003.
4. "Electrical Machines", M.V Deshpande, Wheeler Publishing, 2004.
5. "Electromechanics – I", Kamakshaiah S., Overseas Publishers Pvt. Ltd, 3rd Edition, 2004.

Course Code	DIGITAL ELECTRONIC CIRCUITS		L	T	P	C
21A020307			3	0	0	3
Pre-requisite	Electronic Devices & Circuits	Semester	III			

COURSE OBJECTIVES:

- To teach significance of number systems, conversions, binary codes and functionality of logic gates.
- To discuss different simplification methods for minimizing Boolean functions.
- To impart knowledge on operation, characteristics and various configurations of TTL and CMOS logic families.
- To outline procedures for the analysis and design of combinational and sequential logic circuits.
- To introduce programmable logic devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand various number systems, error detecting, correcting binary codes, logic families, combinational and sequential circuits.

CO2: Apply Boolean laws, k-map and Q-M methods to minimize switching functions. Also describe the various performance metrics for logic families.

CO3: Design combinational and sequential logic circuits.

CO4: Compare different types of Programmable logic devices and logic families.

CO5: Analyze the various Logic families

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	1	-	-	-	-	-	-	3	2
CO2	3	3	2	2	1	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	1	-	-	-	-	-	-	-	3	2
CO4	3	3	2	2	1	-	-	-	-	-	-	-	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	3	2

UNIT - I (12 Hrs)

Number Systems and Codes: Decimal, Binary, Octal, and Hexa-decimal number systems and their conversions, ASCII code, Excess -3 codes, Gray code. Binary codes Classification, Error detection and correction – Parity generators and checkers –Fixed point and floating-point Arithmetic.

Boolean Algebra& Logic Gates: Boolean operations, Boolean functions, Algebraic manipulations, Min-terms and Maxterms, Sum-of-products and Product-of-sum representations, Two-input logic gates, NAND /NOR implementations.

Minimization of Boolean Functions: Karnaugh map, Don't-care conditions, Prime implicants, Minimization of functions using Quine-McClusky method.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize advantages of using different number systems. (L2)
- Explain usefulness of different coding schemes and functionality of logic gates. (L2)
- Apply basic laws and De Morgan's theorems to simplify Boolean expressions. (L3)
- Compare K- Map and Q-M methods of minimizing logic functions. (L5)

UNIT - II (12 Hrs)

Combinational Circuits: Introduction, Analysis of combinational circuits, Design Procedure– Binary Adder-Subtractor, Decimal Adder, Multiplier, Comparator, Code Converters, Encoders, Decoders, Multiplexers, Demultiplexers, Illustrative examples

Sequential Circuits-1: Introduction, Latches –RS latch and JK latch, Flip-flops-RS, JK, T and D flip flops, Master-slave flip flops, Edge-triggered flip-flops, Flip-flop conversions.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Boolean algebra for describing combinational digital circuits. (L2)
- Analyze standard combinational circuits such as adders, subtractors, multipliers, etc. (L4)
- Design various Combinational logic circuits. (L4)
- Implement logic functions with decoders and multiplexers. (L5)

UNIT - III (12 Hrs)

Sequential Circuits-2: Analysis and Design of Synchronous Sequential Circuits: Moore and Mealy machine models, State Equations, State Table, State diagram, State reduction & assignment, Synthesis using flip flops, Elements of Design style, Top–down design, Algorithmic state Machines (ASM), ASM chart notations.

Registers and Counters: Registers, shift registers, Ripple counters, Synchronous counters, Modulus-n Counter, Ring counter, Johnson counter, Up-Down counter.

Learning Outcomes: At the end of this unit, students should be able to

- Describe behaviour of Flip-Flops and Latches. (L2)
- Compare Moore and Mealy machine models. (L5)
- Design synchronous sequential circuits using flip flops and construct digital systems
- Use components such as registers and counters (L4)
- Utilize concepts of state and state transition for analysis and design of sequential circuits (L3)

UNIT - IV (12 Hrs)

Memory and Programmable Logic: RAM, Types of Memories, Memory decoding, ROM, Types of ROM, Programmable Logic Devices (PLDs): Basic concepts, PROM as PLD, Programmable Array Logic (PAL) and Programmable Logic Array (PLA), Design of combinational and sequential circuits using PLDs.

Learning Outcomes: At the end of this unit, students should be able to

- Define RAM, ROM, PROM, EPROM and PLDs. (L1)
- Describe functional differences between different types of RAM & ROM. (L2)
- Compare different types of Programmable Logic Devices. (L5)
- Design simple digital systems using PLDs. (L4)

UNIT-V (12 Hrs)

Digital Logic Families: Unipolar and Bipolar Logic Families, Transistor-Transistor Logic (TTL): Operation of TTL, Current sink logic, TTL with active pull up, TTL with open collector output, Shockley TTL, TTL characteristics, I2L, ECL logic Families.

CMOS: CMOS Inverter, CMOS characteristics, CMOS configurations - Wired Logic, Open drain outputs, Interfacing: TTL to CMOS and CMOS to TTL, Tristate Logic, Characteristics of Digital ICs: Speed, power dissipation, figure of merit, fan-out, Current and voltage parameters, Noise immunity, operating temperature range, power supply requirements.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize significance of various TTL, I2L, ECL and CMOS subfamilies. (L2)
- Examine Interface aspects of TTL & CMOS logic families. (L5)
- Explain characteristics of digital ICs such as speed, power dissipation, figure of merit, fan-out, noise immunity etc. (L2)
- Compare bipolar and MOS logic families. (L5)

TEXTBOOKS:

1. “Digital Design", M. Morris Mano and Michael D. Ciletti, Pearson Education, 4^{th} Edition, 2013.
2. “Switching and Finite Automata Theory”, Z. Kohavi and N. K. Jha, Tata McGraw Hill, Third Edition, 2010.
3. "Modern Digital Electronics", R. P. Jain, McGraw Hill Education, India Private Limited, 4^{th} Edition, 2012.

REFERENCE BOOKS:

1. “Digital Design: Principles and Practices”, J.F Wakerly, Pearson India, 4^{th} Edition, 2008.
2. “Fundamentals of Logic Design”, Charles H Roth (Jr) and Larry L. Kinney, Cengage Learning India Edition, 5^{th} Edition, 2010.
3. “Digital Logic Applications and Design”, John. M Yarbrough, Thomson Learning, 2006

Course Code	ELECTRICAL CIRCUITS & SIMULATION LABORATORY		L	T	P	C
21A020404			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Understand and experimentally verify various resonance phenomenon
- Understand and analyze various current locus diagrams.
- Apply and experimentally analyze the basic two port network parameters
- To understand the fundamentals of electrical circuits by using PSPICE software.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand and compare basic electric circuit theorems with actual working circuits.

CO2: Students can Design and understand RLC series and parallel circuits and its resonance condition.

CO3: They can able to measure power in three phase circuits in day to day life.

CO4: They can also be able to understand simulation programs for DC circuit analysis using PSPICE.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	1	-	3	2	1	-	3	3	2
CO2	-	-	-	-	3	2	-	3	3	2	-	3	3	2
CO3	-	-	-	-	2	1	-	3	2	1	-	3	3	2
CO4	-	-	-	-	2	1	-	3	2	1	-	3	3	2
CO5	-	-	-	-	3	3	-	3	3	3	-	3	3	2

LIST OF EXPERIMENTS:

1. Locus Diagram of RL Series Circuits:
   a) Variable ‘R’ and Fixed ‘L’ b) Variable ‘L’ and Fixed ‘R’
2. Locus Diagram of RC Series Circuits:
   a) Variable ‘R’ and Fixed ‘C’ b) Variable ‘C’ and Fixed ‘R’
3. Series Resonance
4. Parallel Resonance
5. Transient response of RL and RC circuits for DC circuits
6. Determination of Z Parameters
7. Determination of Y Parameters
8. Transmission Parameters
9. Hybrid Parameters
10. Design of low pass and high pass filters

PSPICE SIMULATION EXPERIMENTS:

1. Simulation of DC Circuits
2. Simulation of AC Circuits
3. Simulation of low pass and high pass filters
4. DC Transient Response
5. Mesh Analysis
6. Nodal Analysis

REFERENCE BOOKS:

1. “Fundamentals of Electric Circuits: Lab Manual”, David A. Bell, OUP Canada, 7th Edition, 2009.
2. “Introduction to PSPICE using OrCAD for Circuits and Electronics”, Muhammad H. Rashid, Pearson Education, 3rd Edition, 2003.

Course Code	DIGITAL ELECTRONIC CIRCUITS LAB		L	T	P	C
21A020308			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand working of logic families and logic gates.
CO2: Design and implement Combinational and Sequential logic circuits.
CO3: Understand the process of Analog to Digital conversion and Digital to Analog conversion.
CO4: Use PLDs to implement the given logical problem.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2

LIST OF EXPERIMENTS:

1. To study basic gates (AND, OR, NOT) and verify their truth tables.
2. Design and realization of logic gates using universal gates
3. Realization of Boolean Expressions using Gates
4. Design a 3 – bit Adder / Subtractor
5. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter
6. Design and construct basic flip-flops R-S, J-K, J-K Master slave flip-flops using gates and verify their truth tables
7. Design and realization a Synchronous counters using flip-flops
8. Design and realization of Asynchronous counters using flip-flops
9. Design and realization of 8x1 MUX using 2x1 MUX
10. Realization of logic gates using DTL, TTL, ECL, etc
11. Design and realization 2-bit comparator

12. Design and realization of 8-bit parallel load and serial out shift register using flip-flops
13. Design and realization of 4-bit pseudo random sequence generator using logic gates.
14. State machines

Note: Any 10 experiments should be performed

TEXTBOOKS:

1. "Digital Design", M. Morris Mano and Michael D. Ciletti, Pearson Education, 4th Edition, 2013.
2. "Switching and Finite Automata Theory", Z. Kohavi and N. K. Jha, Tata McGraw Hill, Third Edition, 2010.
3. "Modern Digital Electronics", R. P. Jain, McGraw Hill Education, India Private Limited, 4th Edition, 2012.

REFERENCE BOOKS:

1. "Digital Design: Principles and Practices", J.F Wakerly, Pearson India, 4th Edition, 2008.
2. "Fundamentals of Logic Design", Charles H Roth (Jr) and Larry L. Kinney, Cengage Learning India Edition, 5th Edition, 2010.
3. "Digital Logic Applications and Design", John. M Yarbrough, Thomson Learning, 2006

Course Code	ELECTRICAL MACHINES – I LAB		L	T	P	C
21A020405			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- DC motors and DC Generators
- The speed control techniques of DC motors.
- To conduct various experiments for testing on 1-phase transformers

COURSE OUTCOMES:

After completion of the course the student will be able to

CO1: Conduct and analyze load test on DC shunt generator
CO2: Understand and analyze magnetization characteristics of DC shunt generator
CO3: Understand and analyze speed control techniques and efficiency of DC machines
CO4: Understand to predetermine efficiency and regulation of single-phase Transformers.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	1	-	2	3	-	-	3	3	2
CO2	3	3	2	2	1	1	-	2	3	-	-	3	3	2
CO3	3	3	2	2	1	1	-	2	3	-	-	3	3	2
CO4	3	3	2	2	1	1	-	2	3	-	-	3	3	2

LIST OF EXPERIMENTS:

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Brake test on DC shunt motor. Determination of performance curves.
4. Swinburne's test on DC shunt motor, Predetermination of efficiency.
5. Speed control of DC shunt motor (Armature control and Field control method).
6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
7. OC and SC test on single phase transformer
8. Parallel operation of single-phase transformers.
9. Sumpner's test on single phase transformers.
10. Load test on DC long shunt compound generator. Determination of characteristics.
11. Load test on DC short shunt compound generator. Determination of characteristics.
12. Separation of losses in DC shunt motor.

13. Separation of losses of single-phase transformer.

Note: Minimum ten experiments are required to be performed from the above list

REFERENCE BOOKS:

1. "Laboratory Manual for Electrical Machines", D. P. Kothari and B. S. Umre**,** I.K International Publishing House Pvt. Ltd., 2017.

ONLINE LEARNING RESOURCES:

1. http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=ElectricalEngineering
2. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

Course Code	PYTHON PROGRAMMING		L	T	P	C
21A050701	(Common to CE, EEE, ME & ECE)		1	0	2	2
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- To understand the object-oriented concepts using Python in problem solving.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Student should be able to understand the basic concepts of Python Programming language such as conditional processing, Loops, and other data structures.

CO2: Ability to explore python especially the built-in objects of Python.

CO3: Ability to create practical and contemporary applications such as Machine Learning algorithms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	3	2
CO2	2	2	2	1	3	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	3	-	-	-	-	-	-	-	3	2

Topics to be covered:

Introduction: What is a program, running python, Arithmetic operators, Value and Types.

Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.

Functions: Function Definitions and Uses, Math functions,

Conditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Recursion, Keyboard input.

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, it's Looping

Tuples: Tuples are immutable, Tuple Assignment

Files: Persistence, Reading and writing, Format operator, Filename and paths,

Classes and Objects: Programmer-defined types, Classes, Objects, methods and modules.

The turtle module & tkinter module: graphics-based Object shapes drawing fundamentals, GUI design Fundamentals

LABORATORY EXPERIMENTS:

1. Install Python Interpreter and use it to perform different Mathematical Computations.
2. Write a Python Program to find sum of given n numbers
3. Write a Python Program to generate Fibonacci Numbers up to a given number
4. Write a Python Program to display multiplication Table of a given Number
5. Write a Python Program to read a list of names from keyboard, sort them and write them into a File
6. Write a Python Program to concatenate two files content and write the result into a new File.
7. Write a Python Program to perform the addition of two matrices.
8. Write a Python Program to search a given word in the given text file and display the number of occurrences of the string.
9. Write the step-by-step Solution procedure to find the LCM and GCD (HCF) of 2 given numbers
10. Find mean, median, mode for the given set of numbers in a list
11. Python Code to create module called "mathematics" having functions add (), subtract(), div(), mul() and access them by another Program.
12. Develop Python program for illustrating the object-oriented features supported by Python
13. Write a function that draws a Pyramid with #symbols

```
      #
     #  ##
   #  #  #  ##
 #  #  #  #  #  ##
```

up to 15 hashes at the bottom

14. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Use object-oriented approach.
15. Using turtles concept draw Olympic Symbol
16. The time module provides a function, also named time that returns the current Greenwich Mean
17. Time in "the epoch", which is an arbitrary time used as a reference point

    a. >>> import time

b. >>>time.time () 14377460

a. 94.5735958

18. Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.
19. Given a text of characters, write a program which counts number of vowels, consonants and special characters.
20. Write program which performs the following operations on list's. Don't use built-in functions
    a) Updating elements of a list
    b) Concatenation of list's
    c) Check for member in the list
    d) Insert into the list
    e) Sum the elements of the list
    f) Push and pop element of list
    g) Sorting of list
    h) Finding biggest and smallest elements in the list
    i) Finding common elements in the list
21. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.
22. Develop Python Program to create Login Screen and evaluate user Input?

TEXTBOOKS:

1. "Think Python", Allen B. Downey, SPD/O'Reilly, 2nd Edition, 2016.

REFERENCE BOOKS:

1. "The Complete Reference: Python", Martin C. Brown, McGraw-Hill, 2018.
2. "Fundamentals of Python", Kenneth A. Lambert, B.L. Juneja, CENGAGE, 2015.
3. "Core Python Programming", R. Nageswara Rao, Dreamtech Press, 2nd Edition, 2019

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">CONSTITUTION OF INDIA
(Common to all branches)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A000002</td><td>2</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">III</td></tr>
</table>

COURSE OBJECTIVES

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Understand historical background of the constitution making and its importance for building a democratic India.

CO2: Understand the functioning of three wings of the government ie., executive, legislative and judiciary.

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India.

CO4: Analyze the decentralization of power between central, state and local self-government

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO2	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO3	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO4	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO5	-	-	-	-	-	3	-	2	1	-	-	1	-	-

UNIT - I (10 Hrs)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution- Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Indian constitution (L1)
- Apply the knowledge on directive principle of state policy (L3)
- Analyze the History and features of Indian constitution (L4)
- Learn about Preamble, Fundamental Rights and Duties (L1)

UNIT - II (10 Hrs)

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of Indian government (L1)
- Differentiate between the state and central government (L4)
- Explain the role of President and Prime Minister (L2)
- Know the Structure of supreme court and High court (L1)

UNIT - III (10 Hrs)

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of state government (L1)
- Analyze the role of Governor and Chief Minister (L4)
- Explain the role of State Secretariat (L2)
- Differentiate between structure and functions of state secretariat (L4)

UNIT - IV (10 Hrs)

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning Outcomes: At the end of this unit, students should be able to

- Understand the local Administration (L1)
- Compare and contrast district administration's role and importance (L4)
- Analyze the role of Mayor and elected representatives of Municipalities (L4)
- Learn about the role of Zilla Parishath block level organization (L1)

UNIT-V (10 Hrs)

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Learning Outcomes: At the end of this unit, students should be able to

- Know the role of Election Commission (L1)

- Contrast and compare the role of Chief Election commissioner and Commissionerate (L4)
- Analyze the role of state election commission (L4)
- Evaluate various commissions viz SC/ST/OBC and women (L6)

TEXTBOOKS:

1. "Introduction to the Constitution of India", Durga Das Basu, Prentice Hall of India Pvt. Ltd. New Delhi
2. "Indian Constitution", Subash Kashyap, National Book Trust

REFERENCE BOOKS:

1. "Dynamics of Indian Government & Politics", J.A. Siwach,
2. "Constitutional Law of India", H.M.Sreevai, 4th Edition in 3 volumes (Universal Law Publication)
3. "Indian Government and Politics", J.C. Johari, Hans India

Course Code	ENGINEERING MECHANICS (Common to ME & EEE)		L	T	P	C
21A030302			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.
- To learn the effect of friction on equilibrium.
- To learn kinematics, kinetics of particle and rigid body, related principles.
- Understand Moment of force, Varignon's theorem with applications, couple.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

CO2: Analyze the forces in the members of the frames/truss.

CO3: Understand the concept of friction and its applications.

CO4: Understand the concept of centroid and location of centroid of plane figures and material bodies.

CO5: Understand moment of inertia, determining moment of inertia of plane figures and material bodies.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	3	-	-	-	-	-	2	2
CO2	2	3	3	1	1	-	-	-	-	-	-	-	2	2
CO3	3	3	2	1	1	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	1	-	-	-	-	-	-	-	1	1
CO5	3	2	3	2	2	-	-	-	-	-	-	-	1	1

UNIT - I (12 Hrs)

Introduction to Engineering Mechanics: Basic concepts - System of forces–Resultant of a force system, Moment of forces and its Application & Couples, Spatial Forces-Components in space, Resultant Equilibrium of system forces, free body diagrams.

Types of Supports: Support reactions for beams with different types of loading – concentrated, uniformly distributed load, uniformly varying loading and couple.

Learning Outcomes: At the end of the unit, students should be able to

- Use scalar and vector analytical techniques for analyzing forces (L4)
- Calculate resultant and apply conditions of equilibrium. (L3)

- Demonstrate knowledge of mathematics and mechanics with logics in resolution and composition of force systems. (L3)

UNIT - II (14 Hrs)

Analysis of Perfect Frames: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, Tension Coefficient method and methods of sections for vertical loads, horizontal loads and inclined loads.

Learning Outcomes*:* At the end of the unit, students should be able to

- Understand types of frames and analyze for the forces in the members of the truss by method of joints and method of sections. (L4)
- Analysis of truss, cable, frame and friction. (L4)
- Identify the type of frame and analyze for the forces in the members of the truss (frame) by method of joints and method of sections. (L4)

UNIT - III (12 Hrs)

Friction: Types of friction– Static and Dynamic Frictions, laws of Friction–Limiting friction and impending motions–Cone of limiting friction– Motion of bodies – Wedge friction – Screw jack.

Learning Outcomes*:* At the end of the unit, students should be able to

- Understand the basic concepts of friction(L2)
- Understand various types of friction. (L2)
- Apply type motions and also understand applications of friction. (L3)

UNIT - IV (16Hrs)

Centroid and Centre of Gravity: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies -Centre of Gravity of Composite figures. (Simple problems only)

Moment of Inertia: Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures.

Moment of Inertia: Moment of Inertia of Simple solids, Moment of Inertia of composite masses. (Simple problems only)

Learning Outcomes*:* At the end of the unit, students should be able to

- Understand distributed force systems, Centroid centre of gravity and method of finding Centroids of composite figures and bodies. (L2).
- Understand the moment of inertia and method of finding moment of inertia of areas and bodies. (L2)
- Understand the mass moment of inertia of different solid materials. (L2)

UNIT-V (14 Hrs)

Kinematics: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of A Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies

Learning Outcomes*:* At the end of the unit, students should be able to

- Understand practical examples related to curvilinear motion. (L2)
- Relate kinematics with kinetic equations on linear displacement, velocity and acceleration. (L4)
- Understand the work energy, energy, power, potential energy (L2)
- Understand Kinetics of rigid body rotation. (L2)

TEXTBOOKS:

1. "Engineering Mechanics-Statics and Dynamics", A. Nelson, Tata McGraw Hill Company.
2. "Engineering Mechanics", R.K Bansal, Laxmi Publications
3. "Engineering Mechanics", Bhavikatti and Rajasekharappa

REFERENCE BOOKS:

1. "Engineering Mechanics", S. Timoshenko, D. H. Young and J. V. Rao, Tata McGraw Hill Company
2. "Engineering Mechanics", Ferdinand L. Singer – Harper Collings Publishers

Course Code	ANALOG ELECTRONIC CIRCUITS		L	T	P	C
21A020406			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- List various types of feedback amplifiers, oscillators and large signal Amplifiers.
- Explain the operation of various electronic circuits and linear ICs.
- Apply various types of electronic circuits and regulated power supplies for proper understanding
- Justify choice of transistor configuration in a cascade amplifier.
- Design electronic circuits for a given specification.

COURSE OUTCOMES:

After completion of the course, the student shall be able to

CO1: Discuss various types of feedback amplifiers, oscillators and large signal amplifiers
CO2: Explain the operation of various electronic circuits and linear ICs
CO3: Apply various types of electronic circuits to solve engineering problems
CO4: Justify choice of transistor configuration in a cascade amplifier
CO6: Design electronic circuits for a given specification

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2		-	-	-	-	-	-	-	3	3	2

UNIT - I (12 Hrs)

Multistage Amplifiers: Classification of amplifiers, different coupling schemes used in amplifiers, general analysis of cascade amplifiers, Choice of transistor configuration in a cascade amplifier, frequency response and analysis of two stage RC coupled and direct coupled amplifiers, principles of Darlington amplifier, Cascade amplifier.

***Learning Outcomes**:* At the end of the unit, students should be able to

- Name different coupling schemes in amplifiers (L1)
- Explain the principles of Darlington amplifier (L2)
- Apply multistage amplifiers to solve engineering problems (L3)
- Analyse multistage amplifiers (L4)
- Justify choice of transistor configuration in a cascade amplifier (L5)

UNIT - II (12 Hrs)

Feedback Amplifiers: Concepts of Feedback, Classification of Feedback Amplifiers, Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Effect of Feedback on Amplifier characteristics, Analysis of a feedback Amplifiers – Voltage – Series, Current-Series, Current-shunt and Voltage – shunt.

Oscillators: Sinusoidal Oscillators, Conditions for oscillations, Phase – shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).

Learning Outcomes*:* At the end of the unit, students should be able to

- Classify feedback amplifiers and oscillators (L1)
- Explain the concept of feedback and conditions for oscillations (L2)
- Apply the feedback amplifiers and oscillators to solve engineering problems (L3)
- Analyze feedback amplifiers and oscillator (L4)

UNIT - III (12 Hrs)

Large Signal Amplifiers (Power Amplifiers): Introduction, Classification, Class A large signal amplifiers, second – Harmonic Distortion, Higher – Order Harmonic Generations, Transformer Coupled Class A Audio Power Amplifier, Efficiency of Class A, Class B, Class AB Amplifiers, Distortion in Power Amplifiers, Class C Power Amplifier.

Learning Outcomes*:* At the end of the unit, students should be able to

- Classify the large signal amplifiers (L1)
- Explain the operation of different types of large signal amplifiers (L2)
- Apply large signal amplifiers in a given engineering situation (L3)
- Analyze harmonic distortion in large signal amplifiers (L4)

UNIT - IV (12 Hrs)

Linear Integrated Circuits Operational Amplifier: Introduction, Block diagram of Op-Amp, Characteristics and Equivalent circuits of an ideal op-amp, Inverting and non-inverting amplifier configurations, The Practical op-amp: Introduction, Input offset voltage, offset current, Thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and Gain – bandwidth product, frequency limitations and compensations, transient response.

Learning Outcomes*:* At the end of the unit, students should be able to

- Understand different Offsets present in Op amp & nullification circuits. (L1)
- Examine performance of Op-Amp in open loop and closed configurations. (L2)
- Analyse emitter-coupled differential amplifier. (L3)
- Compare ideal and practical Op-Amps. (L5)

UNIT-V (12 Hrs)

Applications of Linear Integrated Circuits: Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier, Converters: Current to voltage and voltage to current converters, Active Filters: First order filters, second order low pass, high pass, band pass and band reject filters.

Special Purpose Integrated Circuits: Functional block diagram, working, design and applications of Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO 566, PLL 565, Fixed and variable Voltage regulators

Learning Outcomes*:* At the end of the unit, students should be able to

- Understand various applications of Linear ICs (L1)
- Explain operation of Op-Amp in various applications, Timer, Fixed voltage regulators (L2)
- Apply linear ICs in a given engineering situation (L3)

TEXTBOOKS:

1. "Electronic Devices and Circuits", Millman, Halkias and Jit, McGraw Hill Education (India) Private Ltd., 4th Edition, 2015.
2. "Electronic Devices and Circuits", Salivahanan and N. Suresh Kumar, McGraw Hill Education (India) Private Ltd., 4th Edition, 2017.
3. "Op-Amps & Linear ICs", Ramakanth A. Gayakwad, Pearson, 4th Edition, 2017.

REFERENCE BOOKS:

1. "Pulse, Digital and Switching Waveforms", Millman and Taub, Tata McGraw-Hill Education, 3rd Edition, 2011.
2. "Integrated Electronics", J. Milliman, C. C. Halkias and Chetan Parikh, McGraw Hill, 2nd Edition, 2010.
3. "Electronic Devices and Circuits", David A. Bell, Oxford Press, 5th Edition, 2008.
4. "Linear Integrated Circuits", D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003.

Course Code	ELECTRICAL MACHINES - II		L	T	P	C
21A020407			3	0	0	3
Pre-requisite	Electrical Machines - I	Semester	IV			

COURSE OBJECTIVES:

- Understand the fundamentals of AC machines, know equivalent circuit performance characteristics.
- Understand the methods of starting of Induction motors.
- Understand the methods of starting of Synchronous motors.
- Understand the parallel operation of Alternators.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Understand the basics of ac machine windings, construction, principle of working, equivalent circuit of induction and synchronous machines.

CO2: Analyze the phasor diagrams of induction and synchronous machine, parallel operation of alternators, synchronization and load division of synchronous generators.

CO3: Analyze the various methods of starting in single phase induction machines

CO4: Apply the concepts to determine V and inverted V curves and power circles of synchronous motor.

CO5: Analyze the various methods of starting in both induction and synchronous machines.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1		2	2	2	-	-	-	-	1	3	2

UNIT–I (12 Hrs)

Fundamentals of AC machine windings: Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factors.

***Learning Outcomes**:* At the end of the unit, students should be able to

- Understand the fundamentals of various parts used, different types of windings, distribution factor, Air-gap MMF distribution, constant and pulsating magnetic fields, addition of pulsating magnetic fields and revolving magnetic field. (L2)

- Analyze Magnetic and pulsating fields produced by spatially displaced windings and when the windings are spatially shifted by an angle. (L4)
- Apply above concepts to solve numerical problems. (L4)

UNIT–II (12 Hrs)

Induction Machines: Operating principle, Construction, Types (squirrel cage and slip-ring), Starting and Maximum Torque, Equivalent circuit, Phasor Diagram, Torque-Slip Characteristics, power flow in induction machines, Losses and Efficiency, No load and blocked rotor test, Circle diagram-performance characteristics, Numerical problems. Methods of starting, braking and speed control for induction motors, Doubly-Fed Induction Machines, crawling and cogging.

***Learning Outcomes**:* At the end of the unit, students should be able to

- Understand the construction, types, equivalent circuit, torque slip characteristics and various losses present in an induction machine. (L2)
- Analyze the phasor diagram, efficiency, starting and maximum torque, effect of parameter variation on torque speed characteristics (L4)
- Apply above concepts to solve numerical problems. (L4)

UNIT–III (12 Hrs)

Single-phase induction motors: Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and its applications, capacitor start and run single phase motors, reluctance single phase motors, stepper motors, BLDC motors.

***Learning Outcomes**:* At the end of the unit, students should be able to

- Understand induction generator operation, self-excitation, doubly fed induction machines, various methods of starting, braking and speed control of induction motors. (L2)
- Understand the constructional features, principle involved, equivalent circuit of single-phase induction motor and various starting methods and its applications. (L2)
- Apply above concepts to solve numerical problems. (L4)

UNIT–IV (12 Hrs)

Synchronous generators: Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation- EMF, MMF, ZPF and ASA methods. Operating characteristics of synchronous machines, Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division

***Learning Outcomes**:* At the end of the unit, students should be able to

- Understand the constructional features, emf generated, equivalent circuit, armature reaction, voltage regulation, characteristics, two reaction theory of synchronous machine. (L2)

- Analyze the phasor diagrams, parallel operation of alternators, synchronization and load division of synchronous generators. (L4)
- Apply above concepts to solve numerical problems. (L4)

UNIT–V (12 Hrs)

Synchronous motors: Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, Predetermination of V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation and power circles.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the principle of operation, methods of starting, concept of hunting, synchronous condenser and power factor correction of synchronous motors. (L2)
- Analyze the phasor diagram, determination of V and inverted V curves and power circles of synchronous motor. (L4)
- Apply above concepts to solve numerical problems. (L4)

TEXTBOOKS:

1. “Electric Machinery”, A. E. Fitzgerald and C. Kingsley, McGraw Hill Education, 2013.
2. “Electrical Machinery”, P. S. Bimbhra, Khanna Publishers, 2011.

REFERENCE BOOKS:

1. “Performance and design of AC machines”, M. G. Say, CBS Publishers, 2002.
2. “Electric Machines”, I. J. Nagrath and D. P. Kothari, McGraw Hill Education, 2010.
3. “Alternating current machines”, A. S. Langsdorf, McGraw Hill Education, 1984.
4. “Principles of Electric Machines and Power Electronics”, P. C. Sen, John Wiley & Sons, 2007.

Course Code	CONTROL SYSTEMS AND ENGINEERING		L	T	P	C
21A020408			**3**	**0**	**0**	**3**
Pre-requisite	Complex Variables and Transforms	Semester	IV			

COURSE OBJECTIVES:

- Merits and demerits of open loop and closed loop systems; the effect of feedback
- The use of block diagram algebra and Mason's gain formula to find the overall transfer function
- Transient and steady state response, time domain specifications and the concept of Root loci
- Frequency domain specifications, Bode diagrams and Nyquist plots
- State space modelling of Control system

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts of control systems classification, feedback effect, mathematical modelling and apply the concepts of Block diagram reduction, Signal flow graph method

CO2: Analyze time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.

CO3: State the state space formulation for obtaining mathematical and Root locus,

CO4: Understand the Bode, Nyquist, and Polar plots for stability calculations, Design and develop different compensators, controllers

CO5: Analyze the stability concepts, state space models, controllability and observability and demonstrate the use of these techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2		-	-	-	-	-	-	-	3	3	2

UNIT - I (12 Hrs)

Control Systems Concepts: Open loop and closed loop control systems and their differences- Examples of control systems Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchros

***Learning Outcomes*:** At the end of the unit, the student will be able to

- Write the differential equations for mechanical and electrical systems (L3)

- Obtain the transfer function from block diagrams, servo motors and signal flow graphs (L4)

UNIT - II (12 Hrs)

Time Response Analysis: Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the time domain specifications(L4)
- Calculate the steady state errors(L3)
- Understand about Proportional, Integral and Derivative controllers along with combinations(L2)

UNIT–III (12 Hrs)

Stability Analysis in Time Domain: The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the concept of stability in time domain(L4)
- Apply the concept of Routh's stability and Root locus in time do(L4)

UNIT–IV (12 Hrs)

Frequency Response Analysis: Introduction, Frequency domain specifications-Bode Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain Margin-Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate the frequency domain specifications from Bode, Polar and Nyquist plots(L5)
- Design Compensators for various systems(L5)
- Deducing transfer functions from Bode Plots(L3)
- Understand difference between Phase and Gain margins(L2)

UNIT–V (12 Hrs)

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, solving the Time invariant state Equations-

State Transition Matrix and its Properties. System response through State Space models, The concepts of controllability and observability, Duality between controllability and observability

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of state space, controllability and observability(L2)
- Obtain the transfer function from sate space and vice versa(L3)
- Understand the state transition method of solving time invariant state equations(L2)

TEXTBOOKS:

1. "Modern Control Engineering", Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th Edition, 2010.
2. "Control Systems Engineering" J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th Edition, 2007.

REFERENCE BOOKS:

1. "Control Systems Principles & Design" M. Gopal, Mc Graw Hill Education, 4th Edition, 2012.
2. "Automatic Control Systems" B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th Edition, 2003.
3. "Feedback and Control Systems", Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, Schaum's outlines, Mc Graw Hill Education, 2nd Edition, 2013.
4. "Control System Design" Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. "Feedback Control of Dynamic Systems", Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, Pearson, 6th Edition, 2010.

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all branches)		L	T	P	C
21A110203			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To know the various types of Market Structures & pricing methods and its strategies.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Analyse the consumer behaviour with regard to their product or services and measure demand of a particular product or services by applying various methods in given situation

CO2: Determine Break Even Point (BEP) of an enterprise Assess the cost behaviour, costs useful for managerial decision making

CO3: Determine the price of a product or services in given market condition

CO4: Analyze the financial position by using different types of ratios and interpret the financial accounting

CO5: Evaluate the investment proposals under payback period, ARR, IRR, NPV & PI methods

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT- I (11 Hrs)

Introduction to Managerial Economics and Demand Analysis: Managerial Economics– Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand- Demand Forecasting- Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Learning Outcomes: At the end of this unit, students should be able to

- Know the nature and scope of Managerial Economics and its importance. (L1)
- Understand the concept of demand and its determinants. (L2)
- Analyse the elasticity and degree of elasticity. (L4)
- Evaluate demand forecasting methods. (L5)
- Design the process of demand estimation for different types of demand. (L6)

UNIT- II (10 Hrs)

Theory of Production and Cost Analysis:

Production Function – Short-run and Long-run Production Function -Isoquants and Iso costs, MRTS –Least cost combination of Inputs, Cobb-Douglas Production Function - Laws of Returns – Internal and External Economies of scale – **Cost & Break-Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA)–Determination of Break-Even Point (Simple Problems)-Managerial significance of Break-Even Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, Input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)
- Develop Profit appropriation for different levels of business activity. (L6)

UNIT- III (11 Hrs)

Introduction to Markets and New Economic Environment:

Market structures Types of Markets-Perfect and Imperfect Competition- Features of Perfect Competition– Monopoly -Monopolistic Competition –Oligopoly-Price-Output Determination-Pricing Methods and Strategies- Forms of Business Organizations - Sole Proprietorship - Partnership – Joint Stock Companies-Public Sector Enterprises -. New economic Environment - **Economic Liberalization – Privatization – Globalization.**

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know the production function, input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)

UNIT- IV (10 Hrs)

Capital and Capital Budgeting: Concept of Capital-Significance-Types of Capital-Components of Working Capital - Sources of Short-term and Long-term Capital -Estimating Working capital requirements-**Capital Budgeting**–Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate

of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept of Capital Budgeting and its importance in business (L1)
- Contrast and compare different investment appraisal methods. (L4)
- Analyse the process of selection of investment alternative using different appraisal methods. (L4)
- Evaluate methods of Capital budgeting techniques. (L5)
- Design different investment appraisals and make wise investments. (L6)

UNIT–V (10 Hours)

Introduction to Financial Accounting and Analysis: Financial Accounting – Concept – Emerging need and Importance - Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet (with simple adjustments). ***Financial Analysis*** - Ratios- Liquidity, Leverage, Profitability and Activity Ratios (Simple Problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept and convention and significance of accounting. (L1)
- Apply the fundamental knowledge of accounting while posting the Journal entries. (L3)
- Analyze the process and preparation of Financial Accounts and Financial Ratios. (L4)
- Evaluate the Financial performance of an enterprise by using financial statements. (L5)

TEXTBOOKS:

1. "Managerial Economics", Varshney & Maheswari, S. Chand, 2013.
2. "Managerial Economics and Financial Analysis", Aryasri, MGH, 4th Edition, 2019

REFERENCE BOOKS:

1. "Managerial economics", Ahuja HL, S. Chand, 3rd Edition, 2013.
2. "Managerial Economics and Financial Analysis", S. A. Siddiqui and A. S. Siddiqui, New Age International, 2013.
3. "Principles of Business Economics", Joseph G. Nellis and David Parker, Pearson, 2nd Edition, New Delhi.
4. "Managerial Economics in a Global Economy", Dominick Salvatore, Cengage Learning, 2013.

Course Code	ELECTRICAL MACHINES-II LAB		L	T	P	C
21A020409			0	0	3	1.5
Pre-requisite	Electrical Machines - I	Semester	IV			

COURSE OBJECTIVES:

- To experiment in detail on Induction Motors.
- To experiment in detail on Synchronous Motors.

COURSE OUTCOMES:

After completion of the course the student will be able to

CO1: Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single-phase induction motor.

CO2: Predetermine regulation of a three-phase alternator by synchronous impedance & m.m.f methods.

CO3: Predetermine the regulation of Alternator by Zero Power Factor method Xd and Xq determination of salient pole synchronous machine.

CO4: Evaluate and analyze V and inverted V curves of 3 phase synchronous motor

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	3	-	3	-	-	-	-	3	2
CO2	-	-	-	-	2	1	-	2	-	-	-	-	3	2
CO3	-	-	-	-	2	1	-	2	-	-	-	-	3	2
CO4	-	-	-	-	2	1	-	2	-	-	-	-	3	2

LIST OF EXPERIMENTS:

1. No-load & Blocked-rotor tests on Squirrel cage Induction motor.
2. Load test on three phase slip ring Induction motor.
3. Speed control of three phase induction motor
4. Rotor resistance starter for slip ring induction motor
5. Load test on single phase induction motor.
6. Determination of Equivalent circuit of a single phase induction motor.
7. Predetermination of Regulation of a three phase alternator by synchronous impedance & m.m.f methods
8. Predetermination of Regulation of three-phase alternator by Z.P.F. method.
9. Determination of Xd and Xq of a salient pole synchronous machine.
10. V and inverted V curves of a 3-phase synchronous motor.

Note: All the ten experiments are required to be performed

REFERENCE BOOKS:

1. "Laboratory Manual for Electrical Machines" D. P. Kothari and B. S. Umre, I.K International Publishing House Pvt. Ltd, 2017.
2. "A Laboratory Course in Electrical Machines", D. R. Kohli and S.K. Jain, NEM Chand & Bros.

Course Code	CONTROL SYSTEMS AND SIMULATION LAB		L	T	P	C
21A020410			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Determination of transfer functions of various systems and control of it by different methodologies.
- To provide knowledge in the analysis and design of controllers and compensators.
- The characteristics of servo mechanisms which are helpful in automatic control systems.
- To know the stability analysis using MATLAB.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Get the knowledge of feedback control and transfer function of DC servo motor.
CO2: Model the systems and able to design the controllers and compensators.
CO3: Get the knowledge about the effect of poles and zeros location on transient and Steady state behaviour of second order systems and can implement them to practical Systems and MATLAB
CO4: Determine the performance and time domain specifications of first and second order Systems.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	2	3	-	-	-	-	-	1	3	2
CO2	3	2	1	2	2	2	-	-	-	-	-	1	3	2
CO3	3	2	1	2	2	1	-	-	-	-	-	1	3	2
CO4	3	2	1	2	2	1	-	-	-	-	-	1	3	2

LIST OF EXPERIMENTS:

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC Machine
6. Effect of P, PD, PI, PID Controller on a second order system
7. Lag and lead compensation – Magnitude and phase plot
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor

Note: Any Eight of the above experiments are to be performed:

LIST OF SIMULATION EXPERIMENTS:

1. PSPICE simulation of Op-Amp based Integrator and Differentiator circuits.
2. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
3. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB
4. State space model for classical transfer function using MATLAB – Verification

Note: Any two simulation experiments are to be performed:

REFERENCE BOOKS:

1. "Simulation of Electrical and electronics Circuits using PSPICE", M. H. Rashid, M/s PHI Publications.
2. "PSPICE A/D user's manual", Microsim, USA.
3. "PSPICE reference guide", Microsim, USA.
4. "MATLAB and its Tool Books user's manual", MathWorks, USA

Course Code	ANALOG ELECTRONIC CIRCUITS LAB		L	T	P	C
21A020411			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- List various types of feedback amplifiers, oscillators and large signal Amplifiers.
- Explain the operation of various electronic circuits and linear ICs.
- Apply various types of electronic circuits to solve engineering problems
- Analyse various electronic circuits and regulated power supplies for proper understanding
- Justify choice of transistor configuration in a cascade amplifier.
- Design electronic circuits for a given specification.

COURSE OUTCOMES:

After completion of the course, the student shall be able to

CO1: List various types of feedback amplifiers, oscillators and large signal amplifiers
CO2: Explain the operation of various electronic circuits and linear ICs
CO3: Apply various types of electronic circuits to solve engineering problems
CO4: Analyze various electronic circuits and regulated power supplies for proper understanding
CO5: Justify choice of transistor configuration in a cascade amplifier

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	2

LIST OF HARDWARE EXPERIMENTS:

1. Design two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.
2. Design Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.
3. Design voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Design RC Phase shift oscillator and Wien bridge oscillator for the given specifications. Determine the frequency of oscillation.
5. Analyze a Class B complementary symmetry power amplifier and observe the waveforms with and without cross-over distortion. Determine maximum output power and efficiency.

6. Design inverting and non-inverting amplifiers for the given specifications using OP-AMP and verify the same experimentally.
7. Design practical differentiator and integrator circuits using OP-AMP for the given specifications and verify the same practically.
8. Design a second order low pass and high pass active filters using OP-AMP using the given specifications. Verify them practically.
9. Design an astable multi-vibrator circuit for the given specifications using 555 timer. Plot output waveforms.
10. Design a mono stable multi-vibrator circuit for the given specifications using 555 timer. Plot output waveforms.

Note: Any eight of the above hardware experiments should be performed.

LIST OF SIMULATION EXPERIMENTS:

1. Simulate two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.
2. Simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.
3. Simulate voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Simulate RC Phase shift oscillator and Wien bridge oscillator for the given specifications. Determine the frequency of oscillation.

Note: Any 2 of the above experiments with Multisim / PSPICE or equivalent software

TEXTBOOKS:

1. “Electronic Devices and Circuits”, Millman, Halkias and Jit, McGraw Hill Education (India) Private Ltd., 4th Edition, 2015.
2. “Electronic Devices and Circuits”, Salivahanan and N. Suresh Kumar, McGraw Hill Education (India) Private Ltd., 4th Edition, 2017.
3. “Op-Amps & Linear ICs”, Ramakanth A. Gayakwad, Pearson, 4th Edition, 2017.

REFERENCE BOOKS:

1. “Pulse, Digital and Switching Waveforms”, Millman and Taub, Tata McGraw-Hill Education, 3rd Edition, 2011.
2. “Integrated Electronics”, J. Milliman, C. C. Halkias and Chetan Parikh, McGraw Hill, 2nd Edition, 2010.
3. “Electronic Devices and Circuits”, David A. Bell, Oxford Press, 5th Edition, 2008.

Course Code	ELECTRICAL ENGINEERING WORKSHOP-I		L	T	P	C
21A020701			1	0	2	2
Pre-requisite	Fundamentals of Electrical Circuits	Semester	IV			

COURSE OBJECTIVES:

- To know about different tools, abbreviations and symbols in Electrical Engineering
- To learn about types of measuring instruments to measure electrical quantities
- To gain knowledge on different types of earthing and earth resistance
- To study different types of wiring

COURSE OUTCOMES:

After completion of the course, the student shall be able to

CO1: Demonstrate knowledge on different tools used to service the electrical appliances.
CO2: Analyze and understand the various lamps and load connections.
CO3: Understand the importance of earthing in valuable load appliances.
CO4: Demonstrate how to trouble shoot the electrical domestic appliances.
CO5: Perform the soldering practices.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	2

LIST OF EXPERIMENTS:

Task 1:
Introduction to Electrical tools, symbols and abbreviations in Electrical Engineering

Task 2:
Type of Cables and Joints (T and straight joints)

Task 3:
Lamp Connections (Fluorescent tubes and Special lamp connections)

Task 4:
Residential wiring (With Energy meter, Fuses, Switches, Indicators, Lamps)

Task 5:
Trouble shooting of electrical equipments (fan, iron box, mixer-grinder)

Task 6:
Earthing: Study of earthing and measurement of earth resistance

Task 7:
Wiring Practices for various motors and loads

Task 8:
Experimental study of Solar PV system

Task 9:
Basics of Electronic components, Soldering practices and PCB's design

Task 10:
Power semiconductor devises: Terminal identification, Testing and Description

Task 11:
FIRST AID: Know the procedures of first aid for shock treatment to an electrocuted person, Understand and demonstrate types of fire extinguishers.

REFERENCE BOOKS:

1. "Electrical work shop", R. P. Singh, I.K. International Publishing House Pvt. Limited, 2005
2. "Electrical Design Estimating and Costing", K.B. RAINA & S. K. BHATTA CHARYA
3. "Residential and Commercial Industrial Electrical Systems Vol.2", Joshi, TMH
4. "Residential and Commercial Industrial Electrical systems Vol.3", by Joshi, TMH
5. "Industrial Safety management", Deshmukh, TMH
6. "Operation & Maintenance of Electrical Machines Vol – I", B V S Rao
7. "Preventive Maintenance", C.J. Hubert

Course Code	POWER SYSTEM ARCHITECTURE		L	T	P	C
21A020412			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Operation of conventional power generating systems and their components.
- The role of non-conventional power generating systems and their operation and economic aspects.
- Calculation of different transmission line parameters and their use.
- Modeling of transmission line and evaluation of constants.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Remember and understand the concepts of conventional and nonconventional power generating systems. **(K2)**

CO2: Apply the economic aspects to the power generating systems. **(K3)**

CO3: Analyze the transmission lines and obtain the transmission line parameters and constants. **(K4)**

CO4: Design and develop the schemes to improve the generation and capability of transmission line to meet the day-to-day power requirements.**(K5)**

CO5: Describe the design features of electrical distribution systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	3	2	-	2	3	2
CO2	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO3	3	3	2	1	1	-	-	-	3	2	-	3	3	2
CO4	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO5	3	2	1	1	1	1	-	-	-	-	-	-	3	2

UNIT – I (9 Hrs)

Conventional Power Generating Systems:

Thermal Power: Block Diagram of Thermal Power Station (TPS), Brief Description of TPSComponents **Hydro Power:** Selection of Site, Classification, Layout, and Description of Main Components. **Nuclear Power:** Nuclear Fission and Chain Reaction-Principle of Operation of Nuclear Reactor.- Reactor Components: Moderators, Control Rods, Reflectors, and Coolants. Radiation Hazards: Shielding and Safety Precautions -Types of Nuclear Reactors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of layout and design aspects of Thermal, Hydro and Nuclear PowerPlants.(L2)
- Obtain the principle of operation of Thermal, Hydro and Nuclear Power Plants.(L2)

UNIT–II (9 Hrs)

Non- Conventional Power Generating Systems:

Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar

Radiation, Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.

Wind Power Generation: Role and potential of Wind Energy Options, Horizontal and Vertical AxisWind Mills- Performance Characteristics-Pitch & Yaw Controls – Economic Aspects.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of design of Solar, Wind Power generation.(L2)
- Obtain the principle of operation of Solar, Wind Power generation.(L3)

UNIT–III (9 Hrs)

Transmission Line Parameters: Types of conductors - calculation of resistance for solid conductors, Bundle conductors, Skin effect, Proximity effect, the concept of GMR & GMD-Transposition of Power lines- Calculation of inductance for single phase and three phases, single and double circuit lines, symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of capacitance for 2-wire and 3-wire systems, the effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, singleand double circuit lines, Numerical Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Obtain the transmission line parameters for different types of lines and also for symmetrical and asymmetrical single and three-phase, single and double circuit lines.(L3)

UNIT–IV (9 Hrs)

Modeling of Transmission Lines, Insulators and Cables: Classification of Transmission Lines - Short, medium and long lines and their models - representations - Nominal-T, Nominal-π and A, B, C, D Constants. Long Transmission Line-Rigorous Solution, Numerical Problems – Surge Impedance and surge Impedance loading - Types of System Transients - Travelling or Propagation of Surges -– Ferranti effect, Charging current, Types of Insulators, String efficiency, and Methods for improvement, – Voltage Distribution, Calculation of string efficiency, Corona - Description of the phenomenon, factors affecting corona, Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on the weight of Conductor, Stringing chart and sag template and its applications. Types of Cables, Construction, Types of Insulating materials, Numerical Problems

Learning Outcomes: At the end of this unit, students should be able to

- Obtain the classification of transmission lines and A,B,C,D constants for transmission lines, need of shunt compensation.(L3)
- Understand the concept of Corona and SAG equal and unequal levels.(L2)

UNIT–V (9 Hrs)

General Aspects of Distribution Systems: Classification of Distribution Systems -Comparison of DC & AC and Under-Ground & Over-Head Distribution Systems. Voltage Drop and power loss in D.C Distributors for the following cases: Radial D.C Distributors fed at one end and at ends (equal/unequal Voltages), Uniform loading and Ring Main Distributor.

Substations: Location of Substations: Rating of distribution substations, service area within primary feeders.Benefits derived through optimal location of substations.

Classification of substations: Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment – Gas Insulated Substation (GIS).

Learning Outcomes: At the end of this unit, students should be able to

- Compare DC vs AC and under-ground vs over - head distribution systems, types of distribution systems (L3)
- Get the knowledge about design of distribution feeders, voltage drop and power loss in A.C. distributors (L2)
- Learn substation and types of substations, various arrangements in substations (L3)

TEXTBOOKS:

1. “A Text Book on Power System Engineering”, M. L. Soni, P. V. Gupta, U. S. Bhatnagar and A. Chakraborti, Dhanpat Rai& Co. Pvt. Ltd., 1999.
2. “Electric Power Generation Distribution and Utilization”, C.L Wadhwa, New Age International (P) Ltd., 2005.
3. “Non Conventional Energy Sources”, G.D. Rai, Khanna Publishers, 2000.

REFERENCE BOOKS:

1. “Renewable Energy Resources”, John Twidell and Tony Weir, Taylor and Francis Group, 2nd Edition, 2006.
2. “Electrical Power Generation, Transmission and Distribution”, S. N. Singh., PHI, 2003.
3. “Principles of Power Systems”, V.K. Mehta and Rohit Mehta, S. Chand & Company Ltd., New Delhi 2004.
4. “Wind Electrical Systems”, S. N. Bhadra, D. Kastha & S. Banerjee, Oxford University Press, 2013.

Course Code	POWER ELECTRONICS		L	T	P	C
21A020413			3	0	0	3
Pre-requisite	Electronic Devices & Circuits	Semester	V			

COURSE OBJECTIVES:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operation, characteristics and usage of basic Power Semiconductor devices **(K2)**

CO2: Understand different types of Rectifier circuits with different operating conditions. **(K2)**

CO3: Understand DC-DC converters operation and analysis of their characteristics. **(K2)**

CO4: Understand the construction and operation of voltage source inverters, Voltage controllers and Cyclo Converters.**(K2)**

CO5: Apply all the above concepts to solve various numerical problems solving **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	3	2	-	2	3	2
CO2	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO3	3	3	2	1	1	-	-	-	3	2	-	3	3	2
CO4	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO5	3	2	1	1	1	1	-	-	-	-	-	-	3	2

UNIT – I (9 Hrs)

Power Semiconductor Devices: Power Diode, Silicon Control Rectifier(SCR), BJT, MOSFET, IGBT: I-V Characteristics; Dynamic Characteristics of an SCR, Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT, and GTO.

Learning Outcomes: At the end of this unit, students should be able to

- Know the V-I characteristics of different semiconductor devices. (L2)
- Importance of drive circuit for MOSFET, IGBT, and GTO(L2)

UNIT – II (9 Hrs)

Rectifiers: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifierwith R-load and highly inductive load; Input current wave shape, power factor, and effect of source inductance; Dual Converter -Numerical problems.

Learning Outcomes: At the end of this unit, students should be able to

- Derivation of expressions of different configurations of rectifiers. (L2)
- Calculate the Average, R.M.S values of Voltages and Currents(L3)
- Draw its output voltage and current waveforms. (L2)

<u>UNIT – III</u> (9 Hrs)

DC-DC Converters: Elementary Chopper with an active switch and diode, concepts of Duty ratio, control strategies, and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control, and average output voltage of Buck, Boost and Buck-Boost Converters.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of the duty cycle.(L2)
- Analysis of waveforms at steady state of power circuit(L3)
- Derivation of an average output voltage of DC-DC converter.(L3)

<u>UNIT – IV</u> (9 Hrs)

Inverters: Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters –Voltage control techniques for invertersand Pulse width modulation techniques, single-phase current source inverters with ideal switches,basic series inverters, single-phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180-degree mode – 120-degree mode of operation-Numerical problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of pulse width modulation.(L2)
- Analysis of waveforms of single phase and three phase bridge inverters.(L3)
- Derivation of average and RMS output voltage of DC-AC converter.(L2)

<u>UNIT – V</u> (9 Hrs)

AC Voltage Controllers & Cyclo Converters: AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With Rand RL loads – modes of operation of TRIAC – TRIAC with R and RL loads – RMS load voltage, current and power factor - waveforms – Numerical problems.

Cyclo Converters - Midpoint and Bridge connections – Single-phase to single-phase step-up and step-down Cyclo Converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of the phase control and integral cycle control(L2)
- Know the principle operation of voltage and frequency converter.(L3)
- Analysis waveforms of ac voltage converter and Cyclo converter.(L4)

TEXTBOOKS:

1. "Power Electronics: Circuits, Devices, and Applications", M. H. Rashid, PrenticeHall of India, 2nd Edition, 1998
2. "Power Electronics", P. S. Bimbhra, Khanna Publishers, 4th Edition, 2010.
3. "Power Electronics", M. D. Singh & K. B. Khanchandani, Tata Mc Graw Hill Publishing company, 1998.

REFERENCE BOOKS:

1. "Power Electronics", Ned Mohan, Wiley, 2011
2. "Fundamentals of Power Electronics", Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004
3. "Power Electronics", Vedam Subramanyam, New Age International (P) Limited, 1996.
4. "Power Electronics", V. R. Murthy, Oxford University Press, 1st Edition, 2005.
5. "PowerElectronics", P. C. Sen, Tata Mc Graw-Hill Education, 1987.
6. "Power Electronic Control of Alternating Current Motors", J. M. D. Murphy

Course Code	ELECTRICAL MEASUREMENTS		L	T	P	C
21A020414			3	0	0	3
Pre-requisite	Fundamentals of Electrical Circuits	Semester	V			

COURSE OBJECTIVES:

- To understand the basic principles of different types of electrical instruments for the measurement of voltage, current.
- To understand the basic principles of different types of electrical instruments for the measurement of power factor, power and energy.
- To measure RLC parameters using bridge principles.
- To measure Voltages and Currents for High & Low Ratings.
- To understand the principle of magnetic measurements, working of CRO and its applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the working of various instruments used for the measurement of various electrical engineering parameters like voltage, current. **(K2)**

CO2: Understand the working of various instruments used for the measurement of various electrical engineering parameters like power, power factor & Energy. **(K2)**

CO3: Measure RLC parameters using bridge principles. **(K4)**

CO4: Measure Voltages and Currents for High & Low Ratings with suitable equipment and instruments. **(K3)**

CO5: Understand principle of magnetic measurements & working of CRO and Digital meters applications. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	1	-	-	-	1	2	2
CO2	2	2	1	-	1	-	-	-	-	-	-	1	3	2
CO3	3	3	2	1	1	-	-	-	-	-	-	-	1	1
CO4	2	2	1	-	-	-	-	-	-	-	-	1	3	2
CO5	3	2	1	2	-	-	-	-	-	-	-	1	1	1

UNIT–I (9 Hrs)

Measuring Instruments: Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range – Numerical examples.

Learning Outcomes: At the end of the unit, the student will be able to

- Understand the operation of different instruments. (L2)
- Know the different types of errors and their compensation. (L4)
- Distinguish between MC and MI type of instruments(L3)
- Know how control of torque is required in measurements(L4)

UNIT–II (9 Hrs)

Measurement of Power, Power Factor And Energy: Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques;

P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters.

Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter – Numerical examples

Learning Outcomes: At the end of the unit, the student will be able to

- Understand the working principles and construction of different types of Energy meters(L2)
- Calculate the different parameters of the meters(L2)
- Distinguish between low and high power factor ranges in watt meters(L3)
- Know about occurrence of errors and need for compensation for precise and accurate measurement(L4)
- Distinguish between 3-ϕ power factor meters and Energy meters(L3)

UNIT–III (9 Hrs)

D.C & A.C Bridges: Method of Measuring Low, Medium and High Resistances – Sensitivity of Whetstone's Bridge Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of capacitance and loss angle – DeSauty Bridge. Wien's Bridge – Schering Bridge – Numerical Examples.

Learning Outcomes: At the end of the unit, the student will be able to

- Understand the bridge configurations and their applications for various ranges of resistance measurement(L2)
- Compute the unknown parameters of Inductance using the bridges(L3)
- Compute the unknown parameters of Capacitance using the bridges(L3)
- Be able to select appropriate bridge configuration for measurement of R,L and C(L3)

UNIT–IV (9 Hrs)

Instrument Transformers & Potentiometers: Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations.

DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar andCoordinate types- Standardization –Applications.

Learning Outcomes: At the end of the unit, the student will be able to

- Design the various voltage and current measuring instruments.(L5)

- Distinguish between CTs and PTs.(L4)
- Distinguish between DC and AC potentiometers.(L4)

UNIT–V (9 Hrs)

Magnetic Measurements &CRO: Determination of B-H Loop: Methods of Reversals - Six Point magnetic measurement Method A.C. Testing – Iron Loss of Bar Samples – Numerical Examples. Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current and Voltage- Lissajous Patterns

Learning Outcomes: At the end of the unit, the student will be able to

- Understand principle of magnetic measurements.(L2)
- Understand the operation of CRO and its parts.(L2)
- Know about various applications of CRO.(L2)
- Understand various Lissajous patterns.(L2)

TEXTBOOKS:

1. “Electrical & Electronic Measurement & Instruments”, K. Sawhney, Dhanpat Rai & Co. Publications, 2007.
2. “Electrical Measurements and measuring Instruments”, E. W. Golding and F.C. Widdis, Reem Publications, 5th Edition, 2011.

REFERENCE BOOKS:

1. “Electronic Instrumentation”, H. S. Kalsi, Tata McGraw Hill, 3rd Edition, 2011.
2. “Electrical Measurements: Fundamentals, Concepts, Applications”, M.U Reissland, New Age International (P) Limited, 2010.
3. “Electrical & Electronic Measurement & Instrumentation”, R. K. Rajput, S. Chand & Co., 2nd Edition, 2013.

Course Code	DESIGN OF PHOTOVOLTAIC SYSTEMS		L	T	P	C
21A020415			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand the Basics of Photovoltaic Cells.
- To understand the Energy Estimation and cost.
- To analyse of the Maximum PowerPoint Tracking.
- To analyze PV Interfacing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operation, characteristics and usage of basic power semiconductor devices **(K2)**

CO2: Understand the basic concepts of PV Cells.**(K2)**

CO3: Understand the concepts of Energy estimation and Sizing.**(K2)**

CO4: Understand the Design MPPT.**(K2)**

CO5: Analyze PV system along with its interfacing.**(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	3	2	-	2	3	2
CO2	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO3	3	3	2	1	1	-	-	-	3	2	-	3	3	2
CO4	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO5	3	2	1	1	1	1	-	-	-	-	-	-	3	2

UNIT – I (9 Hrs)

PV Cell: A historical perspective, PV cell characteristics and equivalent circuit, Model of PV cell, Short Circuit, Open Circuit and peak power parameters, Datasheet study, Cell efficiency, Effect of temperature, Temperature effect calculation example, Fill factor, PV cell simulation, Series and Parallel Interconnection.

Learning Outcomes: At the end of this unit, students should be able to

- Determine electric field and potentials using Coulomb's law & Gauss law. (L3)
- Analyze Potential differences for different configurations. (L4)
- Classify static electric magnetic fields in different engineering situations. (L2)

UNIT – II (9 Hrs)

Energy Estimation and Sizing PV: Energy from Sun, insolation, and irradiance, insolation variation with time delay, Solar geometry, Insolation on a horizontal flat plate, Sunrise and sunset hour angles, Energy plots in octave, atmospheric effects, air mass, Clearness index Sizing PV for applications without batteries, Examples, Batteries: Introduction, Capacity, C-rate, efficiency, energy and power densities, Battery selection, other energy storage methods, PV system design.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the Concepts of Conduction and Convection currents. (L4)
- Understand the concept of capacitance for parallel plates, spherical & co-axial capacitors. (L3)
- Calculate Energy stored and energy density in a static electric field. (L3)

<u>UNIT–III</u> (9 Hrs)

Maximum Power Point Tracking: MPPT concept, the Input impedance of DC-DC converters - Boost converter, Buck converter, Buck-Boost converter, PV and DC-DC interface, Impedance control methods- voltage scaling, current scaling, Sampling method, Power slope method 1, Power slope method 2, Hill climbing method, Practical points - Housekeeping power supply.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the Concepts of Magnetic field intensity by Biot-Savart Law & Ampere Law. (L4)
- Understand Maxwell's equations. (L2)
- Develop MFI due to an infinite sheet of current and a long filament carrying conductor in Different loops. (L3)

<u>UNIT–IV</u> (9 Hrs)

PV-Battery Interface: Direct PV-battery connection, Charge controller, Battery charger - Understanding current control, slope compensation, simulation of current control, Batteries in series - charge equalization, Batteries in parallel Peltier device – principle, Peltier element – datasheet, Peltier cooling, Thermal aspects- Conduction, Convection, A Peltier refrigeration example, Radiation and mass transport, Demo of Peltier cooling, PV and Water pumping.

Learning Outcomes: At the end of this unit, students should be able to

- Understand scalar magnetic potential and vector magnetic potential and its applications. (L3)
- Calculate the magnetic forces and torque produced by currents in Magnetic Field. (L2)
- Calculate self and mutual Inductances. (L4)

<u>UNIT–V</u> (9 Hrs)

PV and Grid Interface: Grid connection principle, PV to grid topologies, 3ph d-q controlled grid connection- introduction, DQ-axis theory, AC to DC transformation, DC to AC transformation, Complete 3ph grid connection, 1ph d-q controlled grid connection, 3ph PV-Grid interface example, SVPWM – discrete implementation, analog implementation, Application of integrated magnetics, LIFE CYCLE COSTING Growth models, examples, Annual payment and present worth factor.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire knowledge on time varying fields & Faraday's law for Electromagnetic induction (L3)
- Analyze the Concepts Maxwell's Equations in Different Forms. (L4)
- Understand the Concepts Calculation of Poynting vector & Theorem. (L3)
- Analyze the Concepts of Wave Theory (L4)

TEXTBOOKS:

1. "Design of Photovoltaic Systems", L. Umanand

REFERENCE BOOKS:

1. "Non-conventional energy sources", G. D. Rai

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117108141

Course Code	PROGRAMMABLE LOGIC CONTROLLER AND APPLICATIONS		L	T	P	C
21A020416			3	1	0	3
Pre-requisite	Digital Electronic Circuits	Semester	V			

COURSE OBJECTIVES:

- PLC and its basics, architecture, connecting devices and programming
- Implementation of Ladder logic for various Industrial applications
- Explain PLC timers and counters for the control of industrial processes
- PLC logic and arithmetic operations

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Program a PLC for a given basic application.**(K2)**
CO2: Construct Ladder logic for various Industrial applications.**(K3)**
CO3: Illustrate the Various applications of PLC Functions.**(K2)**
CO4: Illustrate various applications of data handling functions.**(K2)**
CO5: Understand the Analog PLC operation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	-	1	-	-	-	1	3	2
CO2	2	1	1	-	-	-	-	-	-	-	-	1	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	2
CO4	2	1	1	-	-	-	-	-	-	-	-	1	3	2
CO5	3	2	1	2	-	-	-	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

PLC Basics: PLC System, I/O Modules and Interfacing, CPU Processor, Programming Equipment, Programming Formats, Construction of PLC Ladder Diagrams, Devices Connected To I/O Modules.

PLC Programming: Input Instructions, Outputs, Operational Procedures, Programming Examples Using Contacts and Coils. Drill Press Operation.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic concepts of Programmable Logic Controllers (L2)
- Understand the Various PLC Instructions (L2)
- Understand the various Operational Procedures in PLC(L2)

UNIT – II (9 Hrs)

Digital Logic Gates, Programming in the Boolean algebra System, Conversion Examples. Ladder Diagrams for Process Control: Ladder Diagrams & Sequence Listings, Ladder Diagram

Construction and Flowchart for Spray Process System.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the Digital Logic Gates. (L2)
- Analyze the Digital Logic gates using Boolean algebra. (L4)
- Analyze the Ladder Diagrams & Sequence Listing .(L3)

UNIT – III (9 Hrs)

PLC Registers: Characteristics of Registers, Module Addressing, Holding Registers, Input Registers, Output Registers.

PLC Functions: Timer Functions & Industrial Applications, Counter Function & Industrial Applications, Arithmetic Functions, Number Comparison Functions, Number Conversion Functions.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the Various PLC Registers (L2)
- Analyze the various PLC Functions (L4)
- Analyze the Industrial applications with the various PLC Functions (L4)

UNIT – IV (9 Hrs)

Data Handling Functions: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep Functions and Their Applications. Bit Pattern and Changing a Bit Shift Register, Sequence Functions and Applications, Controlling of Two-Axis Robots With PLC, Matrix Functions.

Learning Outcomes: At the end of the unit, students should be able to

- Illustrate various Data Handling functions in PLC (L2)
- Understand the Sequencer functions in PLC (L2)
- Analyze the control of Two axis Robot with PLC (L3)

UNIT – V (9 Hrs)

Analog PLC Operation, Types of PLC Analog Modules and Systems, PLC Analog Signal Processing, BCD or Multibit data Processing. PID Modules, PID Tuning, Typical PIDFunctions, PLC Installation, Trouble shooting and Maintenance

Learning Outcomes: At the end of the unit, students should be able to

- Understand the Analog PLC Operation (L2)
- Understand the Typical PID Functions (L2)

TEXTBOOKS:

1. "Programmable Logic Controllers - Principles and Applications", John W. Webb & Ronald A. Reiss, ELSEVIER Ltd., 5th Edition, 2009.

2. "Programmable Logic Controllers", William Bolton, Newnes, Elsevier Ltd., 5th Edition, 2009.

REFERENCE BOOKS:

1. "Programmable Logic Controllers: An Emphasis on design & application", Kelvin T. Erickson, Dogwood Valley Press, 2011.

Course Code	NEURAL NETWORKS & FUZZY LOGIC		L	T	P	C
21A020417			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Importance of AI techniques in engineering applications
- Artificial Neural network and Biological Neural Network concepts
- ANN approach in various Electrical Engineering problems
- Fuzzy Logic and Its use in various Electrical Engineering Applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Approaches and architectures of Artificial Intelligence. **(K3)**
CO2: Analyze Artificial Neural Networks terminologies and techniques **(K2)**
CO3: Development of Fuzzy Logic concept **(K2)**
CO4: Use of Fuzzy Logic for motor control and AVR operation **(K2)**
CO5: Use of Fuzzy Logic controller in an 18 bus bar system **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	3	2	-	2	3	2
CO2	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO3	3	3	2	1	1	-	-	-	3	2	-	3	3	2
CO4	3	3	2	2	1	-	-	-	3	2	-	3	3	2
CO5	3	2	1	1	1	1	-	-	-	-	-	-	3	2

UNIT – I (9 Hrs)

Introduction to Artificial Intelligence: Introduction and motivation –Approaches to AI – Architectures of AI – Symbolic Reasoning System – Rule based Systems - Knowledge Representation – Expert Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Determine electric field and potentials using Coulomb's law & Gauss law. (L3)
- Analyze Potential differences for different configurations. (L4)
- Classify static electric magnetic fields in different engineering situations. (L2)
- Determine the Concepts of Electric dipole, Electrostatic Energy and Energy density. (L3)

UNIT – II (9 Hrs)

Artificial Neural Networks: Basics of ANN - Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules – ADALINE and MADALINE Models –

Perceptron Networks – Back Propagation Neural Networks –Associative Memories.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the Concepts of Conduction and Convection currents. (L4)
- Understand the concept of capacitance for parallel plates, spherical & co-axial capacitors.(L3)
- Calculate Energy stored and energy density in a static electric field. (L3)

<u>UNIT – III</u> (9 Hrs)

ANN Applications to Electrical Systems: ANN approach to Electrical Load Forecasting Problem – System Identification – ControlSystems – Pattern Recognition.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the Concepts of Magnetic field intensity using Biot-Savart Law & Ampere Law.(L4)
- Understand Maxwell's equations. (L2)
- Develop MFI due to an infinite sheet of current and a long filament carrying conductor in different loops. (L3)

<u>UNIT – IV</u> (9 Hrs)

Fuzzy Logic: Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System – Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand scalar magnetic potential and vector magnetic potential and its applications.(L3)
- Calculate the magnetic forces and torque produced by currents in Magnetic Field. (L2)
- Calculate self and mutual Inductances. (L4)

<u>UNIT – V</u> (9 Hrs)

Fuzzy Logic Applications to Electrical Systems: Fuzzy Logic Implementation for Induction Motor Control – Switched Reluctance Motor Control –Fuzzy Excitation Control Systems in Automatic Voltage Regulator - Fuzzy Logic Controller in an 18 Bus Bar System.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire knowledge on time varying fields & Faraday's law for Electromagnetic induction (L3)
- Analyze the Concepts Maxwell's Equations in Different Forms. (L4)
- Understand the Concepts Calculation of Poynting vector & Theorem. (L3)
- Analyze the Concepts of wave theory (L4)

TEXTBOOKS:

1. "Introduction to Neural Networks using MATLAB", S. N. Sivanandam, S. Sumathi and S. N. Deepa, McGraw Hill Edition, 2006.
2. "Fuzzy Logic with Engineering Applications", Timothy J. Ross, WILEY India Edition, 3rd Edition, 2012

REFERENCE BOOKS:

1. "Introduction to Fuzzy Logic using MATLAB", S. N. Sivanandam, S. Sumathi and S. N. Deepa, Springer International Edition, 2013.
2. "Intelligent System – Modeling, Optimization & Control", Yung C. Shin and Chengying Xu, CRC Press, 2009

Course Code	POWER ELECTRONICS LAB		L	T	P	C
21A020418			0	0	3	1.5
Pre-requisite	Electronic Devices & Circuits Lab	Semester	V			

COURSE OBJECTIVES:

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, and cyclo converters with different loads.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques. **(K3)**

CO2: Analyze the operation of single-phase half &fully-controlled converters and inverters with different types of loads. **(K4)**

CO3: Analyze the operation of DC-DC converters. **(K4)**

CO4: Analyze the operation of single-phase AC voltage controllers. **(K4)**

CO5: Analyze the operation of Cyclo converters. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	3		-	2	3	2
CO2	3	3	2	2	1	-	-	-	3		-	3	3	2
CO3	3	3	2	1	1	-	-	-	3		-	3	3	2
CO4	3	3	2	2	1	-	-	-	3		-	3	3	2
CO5	3	2	1	1	1	1	-	-	-		-	2	3	2

LIST OF EXPERIMENTS:

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCRs R triggering (b) R-C triggering
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. DC Jones chopper with R and RL Loads
7. Single Phase Parallel, inverter with R and RL loads
8. Single Phase Cycloconverter with R and RL loads

9. Single Phase half controlled converter with R load
10. Three Phase half controlled bridge converter with R-load
11. Single Phase series inverter with R and RL loads
12. Single Phase Bridge converter with R and RL loads
13. Single Phase dual converter with RL loads.

NOTE: Any ten experiments from the above list should be performed.

REFERENCE BOOKS:

1. "Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)", O.P. Arora, Alpha Science International Ltd., 2007.
2. "Electric and Electronic circuits using PSPICE", M. H. Rashid, M/s PHI Publications.

ONLINE LEARNING RESOURCES:

1. http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php

Course Code	ELECTRICAL MEASUREMENTS LAB		L	T	P	C
21A020419			0	0	3	1.5
Pre-requisite	Electrical Circuit Analysis	Semester	V			

COURSE OBJECTIVES:

- Calibration of various electrical measuring instruments
- Accurate determination of inductance and capacitance using AC Bridges
- Measurement of coefficient of coupling between two coupled coils
- Measurement of resistance for different range of resistors using bridges

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Calibrate various electrical measuring instruments **(K4)**
CO2: Accurately determine the values of inductance and capacitance using AC bridges.**(K3)**
CO3: Compute the coefficient of coupling between two coupled coils. **(K3)**
CO4: Accurately determine the values of very low resistances. **(K3)**
CO5: Measure reactive power in 3-phase circuit using single wattmeter. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	1	-	-	-	1	2	2
CO2	2	2	1	-	1	-	-	-	-	-	-	1	3	2
CO3	3	3	2	1	1	-	-	-	-	-	-	-	1	1
CO4	2	2	1	-	-	-	-	-	-	-	-	1	3	2
CO5	3	2	1	2	-	-	-	-	-	-	-	1	1	1

LIST OF EXPERIMENTS:

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of tolerance
5. Determination of Coefficient of coupling between two mutually coupled coils
6. Determination of Capacitance using Schering Bridge
7. Determination of Inductance using Anderson bridge
8. Measurement of 3-phase reactive power with single-phase wattmeter
9. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods
10. Determination of Inductance using Maxwell's bridge

11. Determination of Capacitance using DeSauty bridge
12. Calibration of LPF wattmeter – by Phantom loading
13. Wheatstone bridge – measurement of medium resistances
14. AC Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil

NOTE: Any ten experiments from the above list should be performed.

TEXTBOOKS:

1. "Electrical & Electronic Measurement & Instruments", A. K. Sawhney and Dhanpat Rai & Co. Publications, 2011, Reprint 2014.
2. "Electrical Measurements and measuring Instruments", E.W. Golding and F.C. Widdis, Reem Publications, 5th Edition, 2011

REFERENCE BOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, Tata McGraw Hill, 3rd Edition, 2011.
2. "Electrical Measurements", Buckingham and Price, Prentice Hall, 1970.
3. "Electrical Measurements: Fundamentals, Concepts, Applications", M. U. Reissland, New Age International (P) Limited, 2010.

ONLINE LEARNING RESOURCES:

1. http://vlabs.iitkgp.ernet.in/asnm/#

Course Code	WEB DESIGNING		L	T	P	C
21A050708			1	0	2	2
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To introduce students with no programming experience to the programming languages and techniques associated with the World Wide Web.
- To introduce web-based media-rich programming tools for creating interactive web pages.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Analyze a web page and identify its elements and attributes. **(K4)**
CO2: Create web pages using XHTML and Cascading Styles sheets. **(K5)**
CO3: Build dynamic web pages. **(K5)**
CO4: Build web applications using PHP. **(K5)**
CO5: Write simple client-side scripts using AJAX **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO2	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-		
CO2	3	2	2	2	3	-	-	-	-	-	-	-		
CO3	2	2	2	2	3	-	-	-	-	-	-	-		
CO4	3	2	3	3	2	-	-	-	-	-	-	-		
CO5	2	3	2	2	2	-	-	-	-	-	-	-		

WEEK – 1:

HTML: What is a browser? What is HTML?, Elements and Tags, Basic HTML5 structure, Metadata , <title>, Adding favicon, Comments, headings.
Task: Create a Basic HTML document.

WEEK – 2:

HTML (continued): Block-Level Elements & Inline Elements, Links (Understand Absolute vs Relative paths), Lists, Images, iframe (embed youtube video).
Task: Create your Profile Page.

WEEK – 3:

HTML (continued): Tables: <table>, <tr>, <th>, <td>, Attributes for each Table element.
Task: Create a Class Timetable (to merge rows/columns, use rowspan/colspan).

WEEK – 4:

HTML (continued): Form Elements: <input>, <select>, <textarea>, <button>, Attributes for each Form element.

Task: Create a Student Hostel Application Form.

WEEK – 5:

Cascading Style Sheets (CSS): CSS Properties, Types of CSS, Selectors, box model, Pseudo elements, z-index.

Task: Make the Hostel Application Form designed in Module -4 beautiful using CSS (add colors, backgrounds, change font properties, borders, etc.)

WEEK – 6:

Bootstrap - CSS Framework: Layouts (Containers, Grid system), Forms, Other Components.

Task: Style the Hostel Application Form designed in Module-5still more beautiful using Bootstrap CSS (Re-size browser and check how the webpage displays in mobile resolution)

WEEK – 7:

HTTP & Browser Developer Tools: Understand HTTP Headers (Request & Response Headers), URL & its Anatomy, Developer Tools: Elements/Inspector, Console, Network, Sources, performance, Application Storage.

Task: Analyze various HTTP requests (initiators, timing diagrams, responses) and identify problems if any.

WEEK – 8:

JavaScript: Variables, Data Types, Operators, Statements, Objects, Functions, Events & Event Listeners, DOM.

Task: Design a simple calculator using JavaScript to perform sum, product, difference, and quotient operation.

WEEK – 9:

Dynamic HTML with JavaScript: Manipulate DOM, Error Handling, Promises, async/await, Modules.

Task: Design& develop a Shopping Cart Application with features including Add Products, Update Quantity, Display Price(Sub-Total & Total), Remove items/products from the cart.

WEEK – 10,11&12:

Design a Dynamic Web Application (at least 3 web pages) of our choice.

TEXTBOOKS:

1. "Programming the World Wide Web", Robet W Sebesta, Pearson, 7th Edition.
2. "Internet and World Wide Web How to Program", Paul J. Deitel, Harvey Deitel, Pearson, 6th Edition, 2020
3. "Web Technologies", Uttam K Roy, Oxford
4. "The Web Warrior Guide to Web Programming", Bai, Ekedahl, Farrelll, Gosselin, Zak, Karparhi, Maclntyre, Morrissey, Cengage.

REFERENCES:

1. "Ruby on Rails Up and Running, Lightning fast Web development", Bruce Tate, Curt Hibbs, Oreilly, 2006
2. "Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book", Dream Tech.
3. "An Introduction to Web Design, Programming", Paul S Wang, Sanda S Katila, Cengage.

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/html/
2. https://www.w3schools.com/js/
3. https://www.w3schools.com/xml/xml_whatis.asp
4. https://www.w3schools.com/php/

Course Code	UNIVERSAL HUMAN VALUES (Common to all branches)		L	T	P	C
21A000003			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the significance and need of values in the society. **(K2)**

CO2: Understand the meaning of Harmony in the Self the Co-existence of Self and Body. **(K2)**

CO3: Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society **(K2)**

CO4: Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. **(K3)**

CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-

UNIT – I (9 Hrs)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the significance and need of values in the society. (L2)

UNIT – II (9 Hrs)

Understanding Harmony in the Human Being - Harmony in Myself: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programs to ensure self-regulation and Health.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the meaning of Harmony in the Self the Co-existence of Self and Body. (L2)
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. (L2)

UNIT – III (9 Hrs)

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order

Learning Outcomes: At the end of this unit, students should be able to

- Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society (L2)

UNIT – IV (9 Hrs)

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at all Levels, and the Holistic Perception of Harmony in Existence.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. (L3)

UNIT – V (9 Hrs)

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Learning Outcomes: At the end of this unit, students should be able to

- Identify the scope and characteristics of people friendly and eco-friendly production systems. (L2)
- Develop appropriate technologies and management patterns for above production systems. (L3)

- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. (L3)

TEXTBOOKS:

1. "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

REFERENCE BOOKS:

1. "Jeevan Vidya: Ek Parichaya", A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. "Human Values", A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. "The Story of My Experiments with Truth", Mohandas Karamchand Gandhi
5. "Small is Beautiful", E. FSchumacher.
6. "Slow is Beautiful", Cecile Andrews
7. "Economy of Permanence", J C Kumarappa
8. "Bharat Mein Angreji Raj", Pandit Sunderlal
9. "Rediscovering India", Dharampal,
10. "Hind Swaraj or Indian Home Rule", Mohandas K. Gandhi,
11. "India Wins Freedom", Maulana Abdul Kalam Azad
12. "Vivekananda", Romain Rolland (English)
13. "Gandhi", Romain Rolland (English)

ONLINE LEARNING RESOURCES:

1. http://www.uhv.org.in/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://www.studocu.com/in/document/dr-apj-abdul-kalam-technical-university/universal-human-valuestechnical-communication/uhv-best-notes/31376289

Course Code	POWER SEMICONDUCTOR DRIVES		L	T	P	C
21A020420			3	0	0	3
Pre-requisite	Power Electronics, Electrical Machines-I, Electrical Machines-II	Semester	VI			

COURSE OBJECTIVES:

- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the choice of the electric drive system based on their applications.**(K2)**

CO2: Explain the operation of single and multi quadrant electric drives.**(K2)**

CO3: Analyze single phase and 3-phase rectifiers fed DC motors and chopper fed DC motors.**(K4)**

CO4: Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors with closed loop, and open loop operations.**(K2)**

CO5: Explain the speed control methods for AC-AC & DC-AC converters fed to Synchronous motors with closed loop, and open loop operations.**(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1		2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Converter fed DC Motors: Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase, Three Phase Semi and Fully Controlled Converters Connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics-Problems.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic electrical drive elements and its function (L2)
- Analyze the single phase dc drives and its speed-torque characteristics (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – II (9 Hrs)

Four Quadrant Operation of DC Drives: Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only)

Learning Outcomes: At the end of the unit, students should be able to

- Understand the four quadrant operation of the dc drives (L2)
- Analyze the various motoring and braking operations of the dc motors (L4)
- Understand the closed loop operation of the dc drives (L3)

UNIT – III (9 Hrs)

Chopper fed DC Motors: Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics– Problems on Chopper Fed D.C Motors.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basics concepts of choppers and its operation (L2)
- Analyze the classification of various choppers feeding the dc drives (L4)

UNIT – IV (9 Hrs)

Control of Induction Motor: Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers – Waveforms – Speed Torque Characteristics - Stator Frequency Control and characteristics. Voltage Source and Current Source Inverter - PWM Control – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Numerical Problems on Induction Motor Drives – Closed Loop Operation of Induction Motor Drives (Block Diagram Only) – Principles of Vector Control Static Rotor Resistance Control – Slip Power Recovery – V/f control of Induction Motor – Their Performance and Speed Torque Characteristics – Advantages- Applications – Problems.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the various speed control methods of induction motor used in drives (L2)
- Analyze the voltage source and current source inverters used in AC drives (L4)
- Apply the various speed control methods to induction motor on rotor side (L3)

UNIT – V (9 Hrs)

Control of Synchronous Motors: Separate Control & Self Control of Synchronous Motors – Operation of Self Controlled Synchronous Motors by VSI and CSI Cyclo-converters. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque

Characteristics – Applications – Advantages and Numerical Problems – Closed Loop Control Operation of Synchronous Motor Drives (Block Diagram Only).

Learning Outcomes: At the end of the unit, students should be able to

- Understand the self and separate control methods of synchronous motor drives (L2)
- Analyze the voltage source and current source inverters used in AC drives (L4)

TEXT BOOKS:

1. "Power semiconductor controlled drives", G K Dubey, Prentice Hall, 1995.
2. "Modern Power Electronics and AC Drives", B. K. Bose, PHI, 2002.

REFERENCE BOOKS:

1. "Power Electronics", MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. "Power Electronic Circuits, Devices and applications", M. H. Rashid, PHI, 2005.
3. "Electric drives Concepts and Applications", Vedam Subramanyam, Tata McGraw Hill Publications, 2nd Edition, 2011.

Course Code	POWER SYSTEM ANALYSIS		L	T	P	C
21A020421			3	0	0	3
Pre-requisite	Power System Architecture	Semester	VI			

COURSE OBJECTIVES:

- The use of per unit values and graph theory concepts, solving a problem using computer
- Formation of Y-bus and Z-bus of a Power System network, power flow studies by various methods.
- Different types of faults and power system analysis for symmetrical and also unsymmetrical faults.
- Analysis of power system for steady state and transient stability and also methods to improve stability.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts of per unit values, Y-Bus and Z-bus formation, load flow studies, symmetrical and unsymmetrical fault calculations. **(K2)**

CO2: Apply the concepts of good algorithm for the given power system network and obtain the converged load flow solution and experiment some of these methods using modern **(K3)**

CO3: Analyze the symmetrical and unsymmetrical faults, stability of the system, perform fault calculations and improve the stability. **(K4)**

CO4: Develop accurate algorithms for different networks and determine load flow studies and zero, positive and negative sequence impedances to find fault calculations. **(K3)**

CO5: Design and select efficient Circuit Breakers to improve system stability. Implement them in resolving various day-to-day issues in a Power System. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

P. U. System and Y-bus Formation: Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, Y-Bus formation by Direct and Singular Transformation Methods, Numerical Problems.

Learning Outcomes:- At the end of the unit, the student will be able to

- Understand the concepts of Per-Unit equivalent system(L2)

- Know about basic graph theory concepts as applied to power systems. (L4)
- Compute the Bus Incidence matrix (L3)
- Formulate Y-Bus matrix using different methods(L4).

<u>UNIT – II</u> (9 Hrs)

Formation of Z-bus : Formation of Z-Bus: Partial network, Algorithm for the Modification of Z-Bus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of Z-Bus for the changes in network (Problems).

Learning Outcomes*:* At the end of the unit, the student will be able to

- Analyze the concept of formation of Z-Bus (L4)
- Develop algorithm for modification of Z-Bus. (L3)
- Determine the Z-Bus matrix(L3)
- Compute modified Z-Bus for the changes in network. (L3)

<u>UNIT – III</u> (9 Hrs)

Power Flow Analysis: static load flow equations – load flow solutions using gauss seidel method: algorithm and flowchart. Acceleration factor, load flow solution for simple power systems (max. 3-buses): newton raphson method in polar co-ordinates form: load flow solution-jacobian elements, algorithm and flowchart. Decoupled and fast decoupled methods.-comparison of different methods.

Learning Outcomes*:* At the end of the unit, the student will be able to

- Understand about Load flow Solution for Simple Power Systems. (L2)
- Determine the Load flow Solution using Gauss Seidel iterative method(L3)
- Determine the Load flow Solution using NR method in polar form (L3)
- Determine solution of DLF and FDLF (L3)
- Know about comparison of various Load flow solutions(L4)

<u>UNIT – IV</u> (9 Hrs)

Short Circuit Analysis: Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory, Positive, Negative and Zero sequence components: Positive, Negative and Zero sequence Networks. Unsymmetrical Fault Analysis: LG, LL, LLG and LLLG faults with and without fault impedance, Numerical Problems.

Learning Outcomes: At the end of the unit, the student will be able to

- Analyze the Calculations of MVA Calculations, Fault levels(L2)
- To understand about Sequence Components. (L2)
- Calculate the fault current using sequence impedances for unsymmetrical faults. (L2)

UNIT – V (9 Hrs)

Stability Analysis: Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers

Learning Outcomes: At the end of the unit, the student will be able to

- Learn the stability and types of stability (L2)
- Analyze the stability using equal area criterion. (L3)
- To understand methods to improve stability (L2)
- Understand and evaluation of fault clearing angle and time. (L2)

TEXTBOOKS:

1. "Computer Methods in Power System Analysis", G. W. Stagg and A. H. El Abiad, Mc Graw Hill, 2006.
2. "Modern Power system Analysis", I. J. Nagrath & D. P. Kothari, Tata McGraw-Hill Publishing Company, 4^{th} Edition, 2011.

REFERENCE BOOKS:

1. "Power System Analysis", Grainger and Stevenson, McGraw Hill, 1994.
2. "Power System Analysis", Hadi Saadat, McGraw Hill, 1998.
3. "Power System Analysis and Design", B. R. Gupta, S. Chand & Company, 2005.

Course Code	DIGITAL COMPUTING PLATFORMS		L	T	P	C
21A020422			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Architecture and designing of 8086 Microprocessor with Assembling language programming and interfacing with various modules
- Understand the Interfacing of 8086 with various advanced communication devices
- Designing of 8051 Microcontroller with Assembling language programming and interfacing with various modules
- To know about Assembly Language Programs for the Digital Signal Processors and usage of Interrupts
- To understand Xilinx programming and understanding of Spartan FPGA board

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic architecture & pin diagram of 8086 microprocessor **(K3)**

CO2: Apply the concepts to design Assembly language programming to perform a given task, Interrupt service routines for all interrupt types. **(K4)**

CO3: Design various applications to Microcontrollers and Microprocessors.**(K5)**

CO4: Write Assembly Language Programs for the Digital Signal Processors and use Interrupts for real-time control applications. **(K5)**

CO5: Write Xilinx programming and understanding of Spartan FPGA board.**(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1		2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Introduction to Microprocessors: Historical background- Evolution of microprocessors up to 64-bit. Architecture of 8086 microprocessor, special function of general purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation - Timing diagrams - CISC and ARM Processors.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic electrical drive elements and its function (L2)
- Analyze the single phase dc drives and its speed-torque characteristics (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – II (9 Hrs)

Assembly Language Programming & I/O Interface: Assembler directives – macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation - A/D - D/A converter interfacing, Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – interfacing interrupt controller 8259 - Need of DMA – serial communication standards – serial data transfer schemes.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic electrical drive elements and its function (L2)
- Analyze the single phase dc drives and its speed-torque characteristics (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – III (9 Hrs)

8051 Micro Controller Programming and Applications: Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises key board and display interface – Closed loop control of servo motor – stepper motor control.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic electrical drive elements and its function (L2)
- Analyze the single phase dc drives and its speed-torque characteristics (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – IV (9 Hrs)

Introduction to TMS320LF2407 DSP Controller: Basic architectural features - Physical Memory - Software Tools. Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers. C2xx DSP CPU and Instruction Set: Introduction & code Generation - Components of the C2xx DSP core - Mapping External Devices to the C2xx core - peripheral interface - system configuration registers - Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction set.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic electrical drive elements and its function (L2)
- Analyze the single phase dc drives and its speed-torque characteristics (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT-V (9 Hrs)

Field Programmable Gate Arrays (FPGA): Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA – Xilinx, XC3000 series - Configurable logic Blocks

(CLB) – Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming –overview of Spartan 3E and Virtex II pro FPGA boards- case study.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic electrical drive elements and its function (L2)
- Analyze the single phase dc drives and its speed-torque characteristics (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

TEXTBOOKS:

1. "Microprocessor Architecture Programming and Applications with 8085", Ramesh S. Gaonkar, Penram Intl. Publishing, 6th Edition, 2013
2. "Advanced Microprocessor and Peripherals", A. K. Ray, K. M. Bhurchandi, Tata McGraw-Hill Publications, 3rd Edition, 2013.

REFERENCE BOOKS:

1. "Microprocessor and Interfacing by Douglas V Hall", Tata McGraw hill, 2nd Edition, 1992
2. "Microprocessor", Nilesh B Bahadure, PHI, 2010.
3. "The 8051 Micro Controller Architecture, Programming and Applications", Kenneth J Ayala, Pearson International publishing (India).
4. "DSP Based Electro Mechanical Motion Control", Hamid A. Tolyat, CRC press, 2004.
5. Application Notes from the webpage of Texas Instruments.
6. XC 3000 series datasheets (version 3.1). Xilinx Inc., USA, 1998
7. XC 4000 series datasheets (version 1.6). Xilinx Inc., USA, 1999
8. "FPGA based system design", Wayne Wolf, Prentice hall, 2004.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106108100
2. https://nptel.ac.in/courses/108105102
3. https://nptel.ac.in/courses/117108040

<table>
<tr><td>Course Code</td><td rowspan="2" colspan="2">POWER SYSTEMS OPERATION & CONTROL</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A020423</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Power System Architecture</td><td>Semester</td><td colspan="4">VI</td></tr>
</table>

COURSE OBJECTIVES:

- To know about economic load dispatch problems with and without losses in Power Systems
- To distinguish between hydro-electric and thermal plants and coordination between them
- To understand about optimal power flow problems and solving using specified method
- To understand about Automatic Generation Control problems and solutions in Power Systems
- To understand necessity of reactive power control, compensation under no-load and load operation of transmission systems
- To understand about deregulation aspects in Power Systems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know about economic load dispatch problems with and without losses in Power Systems. **(K4)**

CO2: Distinguish between hydro-electric and thermal plants and coordination between them.**(K2)**

CO3: Understand about Automatic Generation Control problems.**(K2)**

CO4: Understand about optimal power flow problems.**(K2)**

CO5: Understand about deregulation aspects in Power Systems.**(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1		2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Economic Operation: Optimal Operation of Thermal Power Units, - Heat Rate Curve – Cost Curve –Incremental Fuel and Production Costs, Input-Output Characteristics, Optimum Generation Allocation with Line Losses Neglected. Optimum Generation Allocation Including the Effect of Transmission Line Losses – Loss Coefficients, General Transmission Line Loss Formula

Learning Outcomes: At the end of the unit, students should be able to

- Understand economic load dispatch problem without losses of the Power System(L2)
- Understand economic load dispatch problem with losses of the Power System (L2)
- Know about computation of loss coefficients in Power Systems (L2)

UNIT – II (9 Hrs)

Optimal Scheduling of Hydrothermal System: Hydroelectric Power Plant Models, Scheduling Problems-Short Term Hydrothermal Scheduling Problem.

Optimal Power Flow: Optimal power flow problem formulation for loss and cost minimization, Solution of optimal power flow problem using Newton's method and Linear Programming technique.

Learning Outcomes: At the end of the unit, the student will be able to

- Distinguish between hydro electric and hydro thermal plants.(L2)
- Understand about characteristics of thermo-electric and hydro-thermal plants.(L2)
- Understand about optimal power flow problem formulation with losses and minimization of cost (L2)
- OPF problem solving using specified methods(L2)
- Find the numerical exercises in solving OPF problems(L3)

UNIT – III (9 Hrs)

Load Frequency Control: Speed governing mechanism, modeling of speed governing mechanism, models of various types of thermal plants (first order), Necessity of Keeping Frequency Constant. Definitions of Control Area – Single Area Control – Block Diagram Representation of an Isolated Power System – Steady State Analysis – Dynamic Response – Uncontrolled Case. Load Frequency Control of 2-Area System – Uncontrolled Case Tie-Line Bias Control. Proportional Plus Integral Control of Single Area and Its Block Diagram Representation, Steady State Response

Learning Outcomes: At the end of the unit, the student will be able to

- Understand about speed governing mechanism modeling(L2)
- Identify control areas and block diagram representations (L3)
- Identify Load Frequency Control problems with and without control(L3)
- Understand about steady state and dynamic responses of single and two area system with tie-lines (L2)
- Numerical problems of AGC problems(L2)

UNIT – IV (9 Hrs)

Reactive Power Control: Overview of Reactive Power Control – Reactive Power Compensation in Transmission Systems Advantages and Disadvantages of Different Types of Compensation Equipment for Transmission Systems; Load Compensation – Specifications of Load Compensator, Uncompensated and Compensated Transmission Lines: Shunt and Series Compensation

.

Learning Outcomes: At the end of the unit, the student will be able to

- Know about understanding of Reactive Power problems in Power Systems (L2)
- Distinguish between compensated and uncompensated lines under no-load and load.(L4)
- Distinguish between shunt and series compensation in Reactive Power Control.(L4)

UNIT – V (9 Hrs)

Introduction – Restructuring models utility functions, power exchanges, electricity market models, market power indices, Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting ,ancillary services, transmission pricing methods, demand-side management.

Learning Outcomes: At the end of the unit, the student will be able to

- Understand the philosophy of power exchange in electricity market.(L2)
- Know about transmission system pricing charges.(L2)
- Understand the trend of Demand side management (L2)

TEXTBOOKS:

1. "Power Generation, Operation and Control", Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd Edition, 1996.
2. "Power System Engineering", D P Kothari and I J Nagrath, McGraw Hill Education India Pvt. Limited, Chennai, 3rd Edition, 2019

REFERENCE BOOKS:

1. "Electric Energy Systems Theory: An Introduction", Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd Edition, 1983.
2. "Reactive Power Control in Electric Systems", T J E Miller, John Wiley & Sons, New York, 1982.

Course Code	**MODERN CONTROL THEORY**		**L**	**T**	**P**	**C**
21A020424			**3**	**0**	**0**	**3**
Pre-requisite	Control Systems Engineering	Semester	VI			

COURSE OBJECTIVE:

- Concepts of state vector, State transition matrix and solution of stat equations.
- Importance of controllability and observability concepts.
- Pole placement, state estimation using observers
- Lyapunov criterion for stability analysis
- Types of nonlinearities, their effect on system performance.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Model a given dynamic system in state space, obtain the solution for the state equation **(K2)**
CO2: Test whether a given system is controllable and/or observable **(K3)**
CO3: Design a state feedback controller for pole placement **(K5)**
CO4: Design an observer for state estimation **(K5)**
CO5: Apply Lyapunov criterion and determine stability of a given system **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2		-	-	-	-	-	-	-	3	3	2

UNIT – I (9 Hrs)

State Variable Description and Solution of State Equation: Concept of State – Derivation of State Space models for Linear Continuous time Systems from Schematic Models, Differential equations, Transfer functions and block diagrams – Non uniqueness of state model – State diagrams for continuous time state models – Solution of state equations – State transition matrix. Complete response of continuous time systems.

Learning Outcomes: At the end of the unit, the student will be able to

- Understand the concept of state space models(L2)
- Evaluate the solutions of the state equations.(L3)

UNIT – II (9 Hrs)

Controllability, Observability: Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms. Effect of state feedback on controllability and observability.

Learning Outcomes: At the end of the unit, the student will be able to

- Understand the concepts of controllability and observability. (L2)
- Observe the effect of state feedback on controllability and observability.(L3)

UNIT – III (9 Hrs)

State Feedback Controllers and Observers: Design of State Feedback Controllers through Pole placement. Full-order observer and reduced-order observer. State estimation through Kalman Filters.

Learning Outcomes: At the end of the unit, the student will be able to

- Design of state feedback controller through pole placement.(L4)
- Estimate the state equation through Kalmans Filter.(L3)

UNIT – IV (9 Hrs)

Analysis of Nonlinear Systems: Introduction to nonlinear systems, Types of nonlinearities, Concept of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase plane analysis of nonlinear control systems.

Learning Outcomes: At the end of the unit, the student will be able to

- Analyze the non linear systems with the help of describing functions.(L4)
- Use methods for Isoclines for constructing trajectories.(L2)

UNIT – V (9 Hrs)

Stability Analysis: Stability in the sense of Lyapunov. Lyapunov"s stability and Lyapunov"s instability theorems. Direct method of Lypanov for Linear and Nonlinear continuous time autonomous systems.

Learning Outcomes: At the end of the unit, the student will be able to

- Analyze the stability concepts.(L4)
- Analyze the direct method of Lypanov for Linear and Nonlinear systems.(L4)

TEXTBOOKS:

1. "Modern Control Engineering", Katsuhiko Ogata, Prentice Hall, 5th Edition, 2010.
2. "Modern Control System Theory", M. Gopal, New Age International Publishers, Revised 2nd Edition, 2005.

REFERENCE BOOKS:

1. "Control Systems Engineering", I.J. Nagarath and M.Gopal, New Age International Publishers, 5th Edition, 2007, Reprint 2012.
2. "Modern Control Engineering", D. Roy Choudhury, PHI Learning Private Limited, 9th Edition, January 2015.

Course Code	INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES		L	T	P	C
21A020425			3	0	0	3
Pre-requisite	Electrical Machines-I, Electrical Machines-II	Semester	VI			

COURSE OBJECTIVES:

- Provide good foundation on hybrid and electrical vehicles
- To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles
- Familiarize energy storage systems for electrical and hybrid transportation.
- To design and develop basic schemes of electric vehicles and hybrid electric vehicles.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the working of hybrid and electric vehicles. **(K3)**

CO2: Choose a suitable drive scheme for developing a hybrid and electric vehicles depending on Resources.**(K3)**

CO3: Develop the electric propulsion unit and its control for application of electric vehicles.**(K3)**

CO4: Choose proper energy storage systems for vehicle applications. **(K3)**

CO5: Design and develop basic schemes of electric vehicles and hybrid electric vehicles.**(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1		2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Electric Vehicle Propulsion and Energy Sources: Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. Battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

***Learning Outcomes*:** After successful completion of this unit, the students will be able to

- Summaries the concepts of electrical vehicle propulsion and energy sources. (L2)
- Identify the types of power sources for electrical vehicles.(L3)
- Demonstrate the design considerations for propulsion system. (L2)

UNIT – II (9 Hrs)

Electric Vehicle Power Plant and Drives: Introduction electric vehicle power plants. Induction machines, Permanent magnet machines, Switched reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives- PWM, current control method. Switched reluctance machine drives - voltage control, current control.

Learning Outcomes**:** After successful completion of this unit, the students will be able to

- Choose a suitable drive scheme for developing an electric vehicles depending on resources.(L1)
- List the various power electronic converters. (L1)
- Describe the working principle dc/dc converters and buck boost convertor. (L2)
- Explain about ac drives. (L2)

UNIT – III (9 Hrs)

Hybrid and Electric Drive Trains: Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and Induction motor drives, Permanent magnet motor drives, Switched reluctance motor drives, drive system efficiency.

Learning Outcomes**:** After successful completion of this unit, the students will be able to

- Identify the social importance of hybrid vehicles. (L3)
- Discus impact of modern drive trains in energy supplies. (L6)
- Compare hybrid and electric drive trains.(L2)
- Analyze the power flow control and energy efficiency. (L6)

UNIT – IV (9 Hrs)

Electric and Hybrid Vehicles-Case Studies: Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles

Learning Outcomes**:** After successful completion of this unit, the students will be able to

- List the various electric and hybrid vehicles in the present market. (L1)
- Discus lightly hybridized vehicle and low voltage systems. (L6)
- Explain about hybrid electric heavy duty vehicles and fuel cell heavy duty vehicles. (L2)

UNIT – V (9 Hrs)

Electric and Hybrid Vehicle Design: Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles classification.

***Learning Outcomes*:** After successful completion of this unit, the students will be able to

- Illustrate matching the electric machine and the internal combustion engine. (L2)
- Select the energy storage technology. (L3)
- Select the size of propulsion motor. (L3)
- Design and develop basic schemes of electric and hybrid electric vehicles. (L3)

TEXTBOOKS:

1. "Electric and Hybrid Vehicles: Design Fundamentals", Iqbal Hussein, CRC Press, 2nd Edition, 2003.
2. "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, Illustrated Edition, John Wiley & Sons, 2014.
3. "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, CRC Press, 2004.

REFERENCE BOOKS:

1. "Electric Vehicle Technology Explained", James Larminie, John Lowry, Wiley, 2003.
2. "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", John G. Hayes, G. Abas Goodarzi, 1st Edition, Wiley-Blackwell, 2018.

Course Code	POWER SYSTEMS LAB		L	T	P	C
21A020426			0	0	3	1.5
Pre-requisite	Power System Architecture	Semester	VI			

COURSE OBJECTIVES:

- To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of sub transient reactance's.
- To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
- To develop the MATLAB program for formation of Y and Z buses. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
- To develop the SIMULINK model for single area load frequency problem.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Get the practical knowledge on calculation of sequence impedance, fault currents, voltages and sub transient reactance's. **(K4)**

CO2: Get the practical knowledge on how to draw the equivalent circuit of three winding transformer. **(K3)**

CO3: Get the knowledge on development of MATLAB program for formation of Y and Z buses. **(K3)**

CO4: Get the knowledge on development of MATLAB programs for Gauss-Seidel and Fast Decouple Load Flow studies. **(K3)**

CO5: Get the knowledge on development of SIMULINK model for single area load frequency problem. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1		2	2	2	-	-	-	-	1	3	2

LIST OF EXPERIMENTS:

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
2. Determination of Sequence Impedances of salient pole Synchronous Machine
3. LG Fault Analysis on an un loaded alternator
4. LL Fault Analysis on conventional phases
5. LLG Fault Analysis

6. LLLG Fault Analysis
7. Determination of Sub transient reactance of salient pole synchronous machine
8. Equivalent circuit of three winding transformer.
9. Y Bus formation using Soft Tools
10. Z Bus formation using Soft Tools
11. Gauss-Seidel load flow analysis using Soft Tools
12. Newton-Raphson load flow analysis using Soft Tools
13. Fast decoupled load flow analysis using Soft Tools
14. Solve the Swing equation and Plot the swing curve
15. Develop a model for a uncontrolled single area load frequency control problem and simulate the same using Soft Tools.
16. Develop a model for PI controlled single area load frequency control problem and simulate the same using Soft Tools.
17. Develop a model for a uncontrolled two area load frequency control problem and simulate the same using Soft Tools.
18. Develop a model for PI controlled two area load frequency control problem and simulate the same using Soft Tools.

ONLINE LEARNING RESOURCES:

1. https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html#

Course Code	DIGITAL COMPUTER PLATFORMS LAB		L	T	P	C
21A020427			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Write Assembly language programming on 8086 Microprocessors.
- To Interface various devices with 8086.
- To develop MASAM Programming.
- For Interfacing of 8051 Microcontroller with its peripheral devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic concepts to write assembly language programming on 8086 Microprocessors.**(K2)**

CO2: Design various device configurations and Interfacing of various devices with 8086. **(K5)**

CO3: Understand the basic concepts to write programming on 8051 Microcontroller. **(K2)**

CO4: Design various Interfacing circuitry with 8051 Microcontroller with its peripheral devices.**(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2

LIST OF EXPERIMENTS:

1. Programs for 16 bit arithmetic operations for 8086 (using various addressing modes).
2. Program for sorting an array for 8086
3. Program for searching for a number or character in a string for 8086
4. Program for String manipulations for 8086
5. Interfacing ADC and DAC to 8086.
6. Parallel communication between two microprocessors using 8255.
7. Serial communication between two microprocessor kits using 8251.
8. Interfacing to 8086 and programming to control stepper motor.
9. Programming using arithmetic, logical and bit manipulation instructions of 8051
10. Program and verify Timer/Counter in 8051.

11. Program and verify interrupt handling in 8051.
12. UART operation in 8051.
13. Communication between 8051 kit and PC.
14. Interfacing LCD to 8051.
15. Interfacing matrix or keyboard to 8051.

REFERENCE BOOKS:

1. "Advanced Microprocessor and Peripherals", A. K. Ray, K. M. Bhurchandi, Tata McGraw-Hill Publications, 3rd Edition, 2013.
2. "Microprocessor and Interfacing", Douglas V Hall, 2nd Edition, Tata McGraw hill, 1992
3. "Microprocessors and Microcontrollers Lab Manual: 8086 & 8051", Srinivasa Murthy, Kindle Edition.

Course Code	POWER CONVERTERS USING MATLAB / SIMULINK LAB		L	T	P	C
21A020428			0	0	3	1.5
Pre-requisite	Power Electronics	Semester	VI			

COURSE OBJECTIVES:

- To understand the operation of Power Electronic converters
- To gain knowledge on the programming and simulation of Power Electronics.
- Understand the operation of Power Electronic Drives.
- Enable the students gain a fair knowledge on the simulation of Power Electronics Drives.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand the operation of Power Electronic converters. **(K3)**

CO2: Gain a fair knowledge on the programming and simulation of Power Electronics converters.**(K3)**

CO3: Understand the operation of Power Electronic Drives. **(K3)**

CO4: Acquire skills of computer packages, MATLAB coding and SIMULINK in power electronics drives. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	3	-	-	2	3	2
CO2	3	3	2	2	1	-	-	-	3	-	-	3	3	2
CO3	3	3	2	1	1	-	-	-	3	-	-	3	3	2
CO4	3	3	2	2	1	-	-	-	3	-	-	3	3	2

TOPICS TO BE COVERED:

MATLAB - Introduction, different tool boxes, creation of program files, creation of simulink files, GUI, commonly used blocks, Simpower system toolbox, control system toolbox, Sim Drive lines, Creation of functions, Project implementation through MATLAB

LIST OF EXPERIMENTS:

1. Simulation of Three Phase Fully Controlled Converter with R and R-L Loads using MATLAB/PSIM.
2. Simulation of Three Phase AC Voltage Controller with R and R-L Loads using MATLAB/PSIM.
3. Simulation of Three Phase Inverter in 180^0 Conduction Mode with Star & Delta Connected loads.
4. Simulation of Choppers.
5. Simulation of Single Phase Cycloconverter
6. Simulation of VSI fed Induction motor (square wave and PWM inverters).

7. Simulation of induction motor with open loop constant V/F control.
8. Simulation of Closed loop speed control of BLDC motor.
9. Simulation of speed control of separately excited DC motor.
10. Simulation of PMSM.
11. Implementation of buck and boost dc-dc converters
12. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
13. Simulation of 1-phase and 3-phase transformers

NOTE: Simulation software tools: Matlab/Simulink/PSPICE/PSIM)

ONLINE LEARNING RESOURCES:

1. http://vem-iitg.vlabs.ac.in/
2. https://vp-dei.vlabs.ac.in/Dreamweaver/

Course Code	RESEARCH METHODOLOGY (Common to all branches)		L	T	P	C
21A000004			2	0	0	0
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know how to define a Research problem, select suitable design and experimental approach. **(K1)**

CO2: Formulate sampling design and various techniques implemented on data collection. **(K6)**

CO3: Correlate any two variables and find the solution using regression analysis. **(K4)**

CO4: Examine hypothesis testing procedure, Analyze the significance of variance and covariance. **(K4)**

CO5: Write a report on research work for seminars, conferences formats. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (6 Hrs)

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of research and its process. (L2)
- Explain various types of research. (L2)
- Explain the steps involved in research design. (L2)
- Understand the different research approaches. (L2)

UNIT – II (6 Hrs)

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of sampling and sampling design. (L2)
- Explain various techniques in measurement and scaling. (L2)
- Understand various methods of data collection. (L2)
- Design survey questionnaires for different kinds of research. (L3)
- Analyze the questionnaires. (L4)

UNIT – III (6 Hrs)

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of correlation and regression. (L2)
- Compare and contrast correlation and regression. (L3)
- Explain various types of correlation. (L3)
- Apply the knowledge of C&R Analysis to get the results. (L3)

UNIT – IV (6 Hrs)

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Understand the hypothesis testing procedure. (L2)
- Compare and contrast Parametric and Non-parametric Tests. (L3)
- Understand the use of chi-square test in investigating the distribution of categorical variables. (L2)
- Analyze the significance of variance and covariance. (L4)

UNIT – V (6 Hrs)

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how to write a report and research paper. (L2)
- Explain various techniques of interpretation. (L2)
- Understand the importance of professional ethics in research. (L2)
- Design a scientific paper to present in the conferences/seminars. (L3)

TEXTBOOKS:

1. "Research Methodology: Methods and Techniques", C.R.Kothari, New Age International Publishers, 2nd Edition,.
2. "Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, Sage Publications

REFERENCE BOOKS:

1. "Research Methodology and Statistical Tools", P. Narayana Reddy and G. V. R. K. Acharyulu, Excel Books, New Delhi, 1st Edition.
2. "Business Research Methods", Donald R. Cooper & Pamela S Schindler, 9th Edition.
3. "Fundamentals of Statistics", S C Gupta, Himalaya Publications, 7th Edition

Course Code	AMAZON WEB SERVICES (Common to CSE, EEE)		L	T	P	C
21A050704			0	0	3	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Apply Concept of AWS to implement cloud computing.
- To illustrate the basic AWS Concepts
- Demonstrate the use of AWS Concepts of cloud computing.
- To discuss the implementation of AWS services such as EC2, S3, Load Balancer etc
- To familiarize with cloud deployments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze a cloud computing attributes and implementing different cloud storages. **(K4)**

CO2: Create a S3 bucket for universal data storage, Building a load balancer & VPC for traffic routing. **(K6)**

CO3: Deploying different types of web applications into cloud servers. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	2

LIST OF MODULES:

Week 1:

Creation of AWS account and implementing EC2 services. Login into www.amazonconsole.com and creating a free tier account with individual mail id. Provide proper authentication with the help of credit card and creating instances.

Week 2:

Inspecting all the components of a AWS such as computing, routing, deploying , data storage and creating instances for every option. Monitoring the security aspects in the form of Security groups and creating security groups.

Week 3:

Analysing the different cloud storages such as S3 bucket, EBS. Creating a bucket in S3 and uploading different files in to the S3 bucket. Creating an EBS storage block and uploading bulk data.

Week 4:

The cloud computing is completely depends on networking and the traffic, the traffic must have proper balancing to avoid colloid. We are going to create a Load Balancer with proper traffic diversion rules (X canary) will be implemented for traffic switch.

Week 5:

Virtual Private cloud is one of the major important aspect for Cloud communication. VPC establish a communication between 2 or more private are public cloud. The VPC contains subnets. We can create VPC and subnets in AWS. Implementing the routing table to regularize the traffic.

Week 6:

Security is a major challenging in cloud computing. Security groups are used to create security rolls for the users. creating a security group and adopting different security rules for the cloud services.

Week 7 & 8:

Implement the following cloud computing applications.

1. Create an account with your individual mail id.
2. Connect the EC2 server with the browser by using SSH Key.
3. Implement LINUX commands in the AWS server.
4. Create a security group and download security key.
5. Implement different security roles for the users
6. Create an S3 bucket and upload the different files .txt, .php, .json etc.
7. Create a VPC and subnets to implement traffic switching.
8. Create a load balancer and route the traffic to balance the servers.

Week 9&10:

Ceate a project by using HTML / PHP /Json and upload the project into the server. Verify the accessing of website through IP address. The domain name should be selected and access the uploaded website with its domain naming address. (http://www.google.com) .

Course Code	ELECTRICAL DISTRIBUTION SYSTEMS		L	T	P	C
21A020429			3	0	0	3
Pre-requisite	Power Systems Architecture, Power System Analysis	Semester	VII			

COURSE OBJECTIVES:

- To explain classification of distribution systems
- To understand the aspects and design considerations in DC and AC distribution and their comparison
- To explain technical issues of substations such as location, ratings and bus bar arrangements
- To know the causes of low power factor and methods to improve power factor
- To understand the principles in Distribution automation

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the various factors associated with power distribution. **(K4)**

CO2: Make voltage drop calculations in given distribution networks. **(K3)**

CO3: Learn principles of substation maintenance. **(K3)**

CO4: Compute power factor improvement for a given system and load. **(K4)**

CO5: Understand implementation of SCADA for distribution automation. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Load Modeling and Characteristics: Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural and Industrial) and Their Characteristics.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic concepts of the electrical distribution systems (L2)
- Analyze the relationship between load factor and loss factor(L4)

UNIT – II (9 Hrs)

Classification of Distribution Systems: Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design

Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System. Voltage Drop Calculations (Numerical Problems) In A.C. Distributors for The Following Cases: Power Factors Referred to Receiving End Voltage and With Respect to Respective Load Voltages.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the classification of electrical distribution systems (L2)
- Analyze the design considerations of the radial and loop type feeders (L4)
- Apply the voltage drop calculations of AC and DC distributors (L3)

<u>UNIT – III</u> (9 Hrs)

Substations: Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar, Sectionalized Single Bus Bar, Main and Transfer Bus Bar Double Breaker – One and Half Breaker System With Relevant Diagrams.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the layout of the substation and various equipment installed (L2)
- Analyze the classification of the substation based on insulating medium (L4)
- Understand various bus bar schemes in substation (L3)

<u>UNIT – IV</u> (9 Hrs)

Power Factor Improvement: Voltage Drop and Power-Loss Calculations: Derivation for Voltage Drop and Power Loss in Lines, Manual Methods of Solution for Radial Networks, Three Phase Balanced Primary Lines. Causes of Low P.F -Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Numerical Problems. Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction- Economic Justification - Procedure to Determine the Best Capacitor Location.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines (L4)
- Understand the power factor compensation methods in the lines (L2)
- Apply various power factor correction methods using fixed and switched capacitors (L3)

<u>UNIT – V</u> (9 Hrs)

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer

Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines (L4)
- Understand the power factor compensation methods in the lines (L2)
- Apply various power factor correction methods using fixed and switched capacitors (L3)

TEXTBOOKS:

1. "Electric Power Distribution Engineering", Turan Gonen, CRC Press, 3rd Edition, 2014.
2. "Electric Power Distribution", A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

REFERENCE BOOKS:

1. "Electric Power Distribution Automation", Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010.
2. " Electrical Power Distribution Systems", V. Kamaraju, Jain Book Depot. 2012.
3. " Electrical Power Systems for Industrial Plants", Kamalesh Das, JAICO Publishing House, 2008.

Course Code	POWER SYSTEM PROTECTION		L	T	P	C
21A020430			3	0	0	3
Pre-requisite	Power System Analysis	Semester	VII			

COURSE OBJECTIVES:

- To understand different types of electromagnetic relays and microprocessor based relays.
- To explain the protection of Generators, Transformers, feeders and lines.
- To understand the technical aspects involved in the operation of circuit breakers.
- To provide protection from over voltages.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Distinguish between the principles of operation of electromagnetic relays, static relays and microprocessor based relays. **(K3)**

CO2: Solve numerical problems for arc interruption and recovery in circuit breakers.**(K3)**

CO3: Determine the unprotected percentage of generator winding under fault occurrence and protection of transformers. **(K4)**

CO4: Identify various types of the relays in protecting feeders, lines and bus bars. **(K2)**

CO5: Demonstrate the protection of a power system from over voltages. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1		2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Relays: Electromagnetic Relays - Basic Requirements of Relays – Primary and Backup Protection - Construction Details of – Attracted Armature, Balanced Beam, Inductor Type and Differential Relays – Universal Torque Equation – Characteristics of Over Current, Direction and Distance Relays. Static Relays – Advantages and Disadvantages – Definite Time, Inverse and IDMT. Static Relays – Comparators – Amplitude and Phase Comparators. Microprocessor Based Relays – Advantages and Disadvantages – Block Diagram for Over Current (Definite, Inverse and IDMT) and Distance Relays.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the necessity of relays in power system, & characteristics of different relays. (L2)
- Analyze the construction details of static relays of IDMT and distance relays. (L4)

UNIT – II (9 Hrs)

Fuses: Definitions, characteristics, types, HRC fuses.

Circuit Breakers: Elementary Principles of Arc Interruption, Restriking Voltage and Recovery Voltage - Restriking Phenomenon, Average and Max. RRRV, Current Chopping and Resistance Switching - CB Ratings and Specifications, Types and Numerical Problems. – Auto Reclosures. Description and Operation of Following Types of Circuit Breakers: Minimum Oil Circuit Breakers, Air Blast Circuit Breakers, Vacuum and SF6 Circuit Breakers.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the concept of arc phenomenon in different types of circuit breakers. (L2)
- Understand the operation of circuit breakers and its characteristics of different types relays. (L2)
- Analyze the characteristics of ABCB and SF6 and Vacuum Circuit breakers. (L4)

UNIT – III (9 Hrs)

Protection of Generators & Transformers: Protection of Generators against Stator Faults, Rotor Faults and Abnormal Conditions. Restricted Earth Fault and Inter-Turn Fault Protection – calculation of percentage winding unprotected.

Protection of Transformers: Percentage Differential Protection, Numerical Problems on Design of CT Ratio, Buchholtz Relay Protection, Numerical Problems.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the protection of generators from Inter turn, rotor faults and stator faults.(L2)
- Understand the unprotected percentage of generator winding under fault occurrence.(L4)
- Analyze the operation of Buchholtz Relay Protection in transformers. (L4)

UNIT – IV (9 Hrs)

Protection of Feeders & Lines: Protection of Feeder (Radial & Ring Main) Using Over Current Relays. Protection of Transmission Line – 3 Zone Protection Using Distance Relays. Carrier Current Protection. Protection of Bus Bars.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the concept of radial and ring main feeders protection using relays.(L2)
- Analyze the concept three zone protection in transmission lines. (L4)

UNIT – V (9 Hrs)

Over Voltages in Power Systems: Generation of Over Voltages in Power Systems.-Protection against Lightning over Voltages - Valve Type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the concept of protection of power systems from over voltages(L2)

- Analyze the different types of Lighting arresters and the concept of basic insulation level in power systems. (L4)

TEXTBOOKS:

1. "Power System Protection and Switchgear", Badri Ram, D.N Viswakarma, TMH Publications, 2011.
2. "Switchgear and Protection", Sunil S Rao, Khanna Publishers, 1992.

REFERENCE BOOKS:

1. "Electrical Power Systems", C. L. Wadhwa, New Age international (P) Limited, Publishers, 2012.
2. "Transmission network Protection", Y.G. Paithankar , Taylor and Francis,2009.
3. "Power system protection and switch gear", Bhuvanesh Oza, TMH, 2010

Course Code	SWITCHED MODE POWER CONVERTERS		L	T	P	C
21A020431			3	0	0	3
Pre-requisite	Power Electronics	Semester	VII			

COURSE OBJECTIVES:

- Understand basic concepts of DC-DC converters.
- Understand the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.
- Apply various modulation and harmonic elimination techniques over the converters.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Solve the problems and to design of various DC-DC converters. **(K3)**
CO2: Understand advanced converters of SMPCs. **(K2)**
CO3: Understand various types and performance characteristics of 1-ϕ and 3-ϕ inverters with single/multi levels. **(K2)**
CO4: Understand about power conditioners, UPS and filters . **(K2)**
CO5: Know about the applications of the above in Power Systems, EVE, and Renewable Energy Systems, etc.**(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1		2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

DC-DC Converters: Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples.

Learning Outcomes: At the end of the unit, students should be able to

- Understand and analyze various types of DC-DC converters (L2)
- Understand state space modeling of DC-DC converters (L2)
- Distinguish between stepdown and stepup converters (L2)
- Apply the above concepts to solve numerical problems (L4)

UNIT – II (9 Hrs)

Switching Mode Power Converters: Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical examples.

Learning Outcomes: At the end of the unit, students should be able to

- Understand various types of converters (L2)
- Know about state space modelling of converters (L2)
- Understand about various control circuits & PWM techniques (L2)
- Apply the above concepts to solve numerical problems (L4)

UNIT – III (9 Hrs)

Resonant Converters: Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples.

Learning Outcomes: At the end of the unit, students should be able to

- Understand and analyze various types of resonant converters(L2)
- Classification of resonant converters(L2)
- know about output voltages and its waveforms for various configurations(L4)
- Distinguish between series and parallel resonant converters(L2)
- Apply the above concepts to solve numerical problems(L4)

UNIT – IV (9 Hrs)

DC-AC Converters: Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

Learning Outcomes: At the end of the unit, students should be able to

- Understand and analyze different single phase and three phase inverters(L2)
- Understand various modulation techniques(L2)
- Understand various harmonic elimination techniques(L2)
- Understand various types of multilevel inverters with waveforms and their applications(L2)
- Apply the above concepts to solve numerical problems(L4)

UNIT – V (9 Hrs)

Power Conditioners, UPS & Filters: Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

Learning Outcomes: At the end of the unit, students should be able to

- Understand different types of power line disturbances, power conditioners, in detail working of UPS and its applications.(L2)

- Understand various types of filters with and without capacitors and selection of capacitors. (L2)
- Design inductor and transformer for various power electronic applications.(L2)

TEXTBOOKS:

1. “Power Electronics: Essentials and Applications”, L. Umanand, Wiley, 2009
2. “ Power Electronics handbook”, M.H. Rashid, Elsevier Publication, 2001
3. “Course material on Switched Mode Power Conversion”, V Ramanarayanan, Dept. of Electrical Engg. IISc. Bangalore.

REFERENCE BOOKS:

1. “Elements of Power Electronics”, Philip T. Krein, Oxford University Press, 2012
2. “Power Electronics converters, Applications and design”, Ned Mohan, Tore. M. Undeland, William. P. Robbins, John Wiley and Sons, 3rd Edition, 2006
3. “Power Electronics circuits, devices and applications”, M.H. Rashid, Prentice Hall of India New Delhi, 3rd Edition, 2007.

<table>
<tr><td>Course Code</td><td rowspan="2" colspan="2">ELECTRICAL MACHINE DESIGN</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A020432</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Electrical Machines – I, Electrical Machines – II</td><td>Semester</td><td colspan="4">VII</td></tr>
</table>

COURSE OBJECTIVES:

- Know about designing of DC machines along with windings.
- Understand about overall designing of 1-ϕ transformer.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Understand various design factors, types of windings, choice of machine, selection and Ratings.**(K2)**
CO2: Design DC machine based on specified rating. **(K5)**
CO3: Design 1-ϕ transformer based on specified rating . **(K5)**
CO4: Design 3-ϕ Induction machine based on specified rating. **(K5)**
CO5: Design 3-ϕ Synchronous machine based on specified rating. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Design Factors, Heating and Cooling: Introduction, Design factors, Limitations in Design. Theory of solid body heating, Heating time constant and estimation, Selection of machine power rating, types of duties and ratings (Description only), Selection of motor capacity for continuous, short-time and Intermittent periodic duty ratings, Concept of the methods used for determination of machine rating for variable loads.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the fundamental aspects of design parameters and limitations in designing.(L2)
- Understand the heating and cooling phenomenon in selection of machine rating and types of ratings(L2)
- Understand the design aspects of continuous and short time ratings of machines.(L2)
- Understand the design aspects of machine for variable loads (L2)

UNIT – II (9 Hrs)

Design of DC Machines: Output equation and main dimensions, choice of flux density, choice of ampere-conductors, Selection of number of poles, Length of air gap, Design of field winding, Simplex Lap and Wave windings-Numerical examples.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the designing aspects of DC machines with respect to performance equations and characteristics(L2).
- Understand the necessity of air gap and its length requirement between armature and field(L2)
- Understand the classification of field windings and design of them.(L2)
- Understand the about complete design aspects of DC machines(L2)
- Understand the design DC machine based on the specified ratings(L2)

UNIT – III (9 Hrs)

Design of Single Phase Transformers: Output of transformer, Design of core, Selection of type of winding, Design of insulation, Overall design, No-load current estimation, Design of tank with tubes-Numerical examples.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the design aspects of 1-ϕ transformer based on performance equations.(L2)
- Understand the about the design aspects based on core, type of winding.(L2)
- Understand the design of tanks in 1-ϕ transformers.(L2)
- Understand the design aspects of insulations in transformers.(L2)
- Understand the complete design aspects of 1-ϕ transformers and to be able to design for specified rating.(L2)

UNIT – IV (9 Hrs)

Design of Induction Machines: Three phase Induction machine output equation and main dimensions, Selection of stator and rotor slots, Length of air gap, and Reduction of harmonic torques, Hemitropic, whole coil and Mush windings-Numerical examples.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the design aspects of three phase induction machines based on performance equations.(L4)
- Understand the selection of stator and rotor slots, air gap , necessity mitigating harmonic torque.(L2)
- Analyze the various winding designs of induction machines and to distinguish between squirrel cage & slip ring machines.(L4)
- Understand the complete aspects of 3-ϕ induction machine and to be able to design for a specified rating.(L2)

UNIT – V (9 Hrs)

Design of Synchronous Machines: Output equation, Main dimensions for cylindrical and salient pole machines, Choice of specific magnetic and electric loadings, Effect of SCR on machine performance, Length of air gap, Selection of stator slots, and mitigation of harmonics- Numerical examples.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the design aspects of synchronous machines based on performance equations. (L2)
- Analyze the distinguish between cylindrical and salient pole machines. (L4)
- Understand the synchronous machine based on shunt circuit ratio calculations. (L2)
- Analyze the specific electric and magnetic loads and their choice. (L4)
- Understand the complete design aspects of 3-ϕ synchronous machine and to be able to design for a specified rating. (L2)

TEXTBOOKS:

1. “A course on Electrical Machine Design”, A.K. Sawhney and Chakrabarti, Dhanpat Rai & Co Pvt. Ltd., 6th Edition, 2014.
2. “Design of Electrical Machines”, K. G. Upadhyay, New Age International Pvt. Ltd., 1st Edition, 2018.

REFERENCE BOOKS:

1. “The performance and Design of Alternating Current Machines”, M G Say, CBS Publishers & Distributors, New Delhi, 3rd Edition, 2002.
2. “Performance and Design of Direct Current Machines”, A. E. Clayton and N N Hancock, CBS Publication, 3rd Edition, 2004.
3. “Design of Electrical Machines”, V. N. Mittle and Aravind Mittal, Standard Publishers Distributions, 2009.
4. “Principles of Electrical Machine Design”, R. K. Agarwal, S.K. Kataria & Sons, 2010

Course Code	UTILIZATION OF ELECTRICAL ENERGY		L	T	P	C
21A020433			**3**	**0**	**0**	**3**
Pre-requisite	Power System Architecture	Semester	VII			

COURSE OBJECTIVES:

- The laws of illumination and their application for various lighting schemes
- Principles and methods for electric heating and welding.
- Systems of electric traction, study of traction equipment, mechanics of train movement and associated calculations

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Develop a lighting scheme for a given practical case. **(K3)**
CO2: Analyze the performance of Heating and Welding methods. **(K4)**
CO3: Make all numerical calculations associated with electric traction. **(K3)**
CO4: Analyze the characteristics of Electric traction and its calculations **(K4)**
CO5: Assess the economic aspects in utilization of electrical energy. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	-	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Illumination: Definition –Laws of Illumination–Polar Curves – Calculation of MHCP and MSCP. Lamps: Incandescent Lamp, Sodium Vapour Lamp, Fluorescent Lamp, CFL and LED. Requirement of Good Lighting Scheme – Types, Design and Calculation of Illumination. Street Lighting and Factory Lighting – Numerical Problems – Energy Conservation methods.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the Illumination concepts and its Laws.(L2)
- Understand the different energy conservation methods(L2)
- To know the different Types of Lamps.(L3)
- Evaluate the illumination levels.(L4)

UNIT – II (9 Hrs)

Electric Heating & Welding: Electrical Heating: Advantages. Methods of Electric Heating – Resistance, Arc, Induction and Dielectric Heating – Energy conservation methods. Electric

Welding: Types – Resistance, Electric Arc, Gas Welding. Ultrasonic, Welding Electrodes of Various Metals, Defects in Welding. Electrolysis - Faraday's Laws, Applications of Electrolysis, Power Supply for Electrolysis.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the heating concepts and its energy conservation methods. (L4)
- Analyze the welding methods and its energy conservation methods. (L4)
- Understand the concept of Faraday's laws and need for electrolysis in Illumination. (L2)

UNIT – III (9 Hrs)

Electric Traction–I: Introduction – Systems of Electric Traction. Comparison Between AC and DC Traction – Special Features of Traction Motors - The Locomotive – Wheel arrangement and Riding Qualities – Transmission of Drive – Characteristics and Control of Locomotives and Motor Coaches for Track Electrification – DC Equipment – AC Equipment – Electric Braking with DC Motors and with AC Motors – Control Gear –Auxiliary Equipment – Track Equipment and Collector Gear – Conductor-Rail Equipment – Overhead Equipment – Calculation of Sags and Tensions – Collector Gear for Overhead Equipment.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the electric traction and its classifications.(L2)
- Evaluate the sags and tension of the traction systems.(L4)
- Understand the braking methods in AC and DC traction systems.(L2)

UNIT – IV (9 Hrs)

Electric Traction–II: Mechanics of Train Movement. Speed-Time Curves of Different Services – Trapezoidal and Quadrilateral Speed-Time Curves – Numerical Problems. Calculations of Tractive Effort, Power, Specific Energy Consumption - Effect of Varying Acceleration and Braking Retardation, Adhesive Weight and Coefficient of Adhesion – Problems.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the characteristics of Traction systems and its calculations. (L2)
- Evaluate the effects of accelerating and braking concepts in traction motors.(L4)
- Evaluate the adhesive and coefficient adhesion in different tractions.(L4)

UNIT – V (9 Hrs)

Economic Aspects of Utilizing Electrical energy: Power Factor Improvement, Load Factor improvement, Off Peak Loads- Use of Exhaust Steam, Waste Heat recovery, Pit Head Generation, Diesel Plant, General Comparison of Private Plant and Public Supply- Initial Cost and Efficiency, Capitalization of Losses, Choice of Voltage.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the economic aspects in utilization. (L2)

- Understand the concepts of power factor and load factor improvement methods in utilization.(L2)

TEXTBOOKS:

1. "Utilization of Electric Energy", E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. "Art & Science of Utilization of electrical Energy", Partab, Dhanpat Rai & Co., 2004.

REFERENCE BOOKS:

1. "Generation, distribution and utilization of electrical energy", C.L Wadhwa, Wiley Eastern Limited,1993
2. "Electrical Power", S. L. Uppal, Khanna pulishers,1988.

Course Code	POWER QUALITY		L	T	P	C
21A020434			3	0	0	3
Pre-requisite	Power System Architecture, Power System Analysis	Semester	VII			

COURSE OBJECTIVES:

- To know about introduction on power quality issues.
- To learn about voltage disturbances and power transients that is occurring in power Systems.
- To know the concept of harmonics in the system and their effect on different power system equipment.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Knowledge about introduction on power quality issues.**(K3)**

CO2: Analyze voltage disturbances and power transients that are occurring in power systems.**(K4)**

CO3: Understand the concept of harmonics in the system and their effect on different power system equipment. **(K2)**

CO4: Knowledge about different power quality measuring and monitoring concepts.**(K4)**

CO5: Knowledge about power quality enhancement using custom power devices. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Introduction: Definition of Power Quality- Power Quality Terminology – Classification of Power Quality Issues-Magnitude versus Duration Plot - Power Quality Standards - Responsibilities of Suppliers and Users of Electric Power-CBEMA and ITI Curves.

Learning Outcomes: At the end of the unit, students should be able to

- Learn about various issues of power quality (L2)
- Know about the evaluation procedure of power quality issues(L2)
- Distinguish between short duration and long duration over voltages(L3)
- Know about voltage fluctuations and power frequency variations (L2)

- Learn about CBEMA and ITI curves in power quality issues (L2)

UNIT – II (9 Hrs)

Transients, Short Duration and Long Duration Variations: Categories and Characteristics of Electromagnetic Phenomena in Power Systems- Impulsive and Oscillatory Transients-Interruption - Sag-Swell-Sustained Interruption - Under Voltage – Over Voltage–Outage. Sources of Different Power Quality Disturbances- Principles of Regulating the Voltage-Conventional Devices for Voltage Regulation.

Learning Outcomes: At the end of the unit, students should be able to

- Understand what is meant by voltage sag(L2)
- Know about voltage sag performance estimations(L2)
- Know about fundamental principles of protection from sag and to study various protection schemes (L2)
- Understand about various devices for over voltage protection(L2)
- Know about utility system lightning protections.(L2)

UNIT – III (9 Hrs)

Fundamentals of Harmonics & Applied Harmonics: Harmonic Distortion, Voltage Versus Current Distortion, Harmonics Versus Transients, Power System Quality Under Non Sinusoidal Conditions, Harmonic Indices, Harmonic Sources from Commercial Loads, Harmonic Sources from Industrial Loads. Applied Harmonics**:** Effects Of Harmonics, Harmonic Distortion Evaluations, Principles of Controlling Harmonics, Devices for Controlling Harmonic Distortion.

Learning Outcomes: At the end of the unit, students should be able to

- Understand about effects of harmonics(L2)
- Distinguish between voltage and current harmonics(L3)
- Understand about computation of harmonic indices (L2)
- Understand about the filters used for controlling harmonic distortion (L2)

UNIT – IV (9 Hrs)

Power Quality Monitoring: Power Quality Benchmarking-Monitoring Considerations-Choosing Monitoring Locations- Permanent Power Quality Monitoring Equipment-Historical Perspective of Power Quality Measuring Instruments- Power Quality Measurement Equipment-Types of Instruments- Assessment of Power Quality Measurement Data- Power Quality Monitoring Standards.

Learning Outcomes: At the end of the unit, students should be able to

- Know about what is meant by bench marking in power quality issues. (L2)
- Identify and able to compute voltage variation indices. (L3)
- Identify and able to compute harmonic indices. (L3)

UNIT – V (9 Hrs)

Power Quality Enhancement using Custom Power Devices: Introduction to Custom Power Devices-Network Reconfiguring Type: Solid State Current Limiter (SSCL)-Solid State Breaker (SSB) -Solid State Transfer Switch (SSTS) - Compensating Type: Dynamic Voltage Restorer (DVR)-Unified Power Quality Conditioner(UPQC)-Principle of Operation Only.

Learning Outcomes: At the end of the unit, students should be able to

- Know about power quality enhancement considerations.(L2)
- Know about power quality custom power devices.(L2)

TEXTBOOKS:

1. "Electrical Power Systems Quality", Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Mc Graw Hill Education (India) Pvt. Ltd., 3rd Edition, 2012.
2. "Power quality", C. Sankaran, CRC Press.

REFERENCE BOOKS:

1. "Understanding Power quality problems – Voltage Sags and Interruptions", Math H. J. Bollen IEEE Press Series on Power Engineering, WILEY, 2007.
2. "Power quality – VAR Compensation in Power Systems", R. Sastry Vedam, Mulukutla S. Sarma, CRC Press, 2009, First Indian Reprint 2013.
3. "Fundamentals of Electric Power Quality", Surya Santoso, Create Space, 2012.

Course Code	CONCEPTS OF DIGITAL SIGNAL PROCESSING		L	T	P	C
21A020435			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To describe discrete time signals and systems.
- To teach importance of FFT algorithm for computation of Discrete Fourier Transform.
- To expose various implementations of digital filter structures.
- To present FIR and IIR Filter design procedures.
- To outline need of Multi-rate Processing

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Formulate difference equations for the given discrete time systems. **(K2)**
CO2: Apply FFT algorithms for determining the DFT of a given signal. **(K3)**
CO3: Design IIR digital filter from the given specification. **(K3)**
CO4: Design FIR digital filter from the given specifications. **(K3)**
CO5: Outline the concept of multi rate DSP and applications of DSP. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction to Discrete Time Signals and Systems: Introduction to digital signal processing, review of discrete-time signals and systems, analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different types of signals and systems. (L2)
- Describe discrete time signal. (L2)
- Analyze the linear time-invariant systems by Z transform. (L3)

UNIT – II (9 Hrs)

Discrete Flourier transform: Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transforms: Efficient computation of DFT algorithms - Radix 2-Decimation-in-Time&Decimation-in-Frequencyalgorithms, Inverse FFT, Illustrative problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of DFT and its properties.(L1)
- Find N-Point DFT/FFT for a given signal /sequence.(L2)

UNIT – III (9 Hrs)

IIR Filters - Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.

Learning Outcomes: At the end of this unit, students should be able to

- Understands signal flow graph and block diagram representations of difference
- Equations that realize digital filters.(L1)
- Realization of different structures for IIR filters.(L2)
- Design of IIR filters using different techniques.(L4)

UNIT – IV (9 Hrs)

FIR Filters - Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Hanning, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of FIR filter(L1)
- Realization of different structures for FIR filters(L2)
- FIR filter design based on windowing methods.(L4)
- Compare FIR and IIR filters(L5)

UNIT – V (9 Hrs)

Quantization Errors in Digital Signal Processing: Representation of numbers, Quantization of filter coefficients, Round-off Effects in digital filters.

Multi rate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Polyphase decomposition.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the types Quantization of errors. (L1)
- Analyze the effect of coefficient quantization. (L4)
- Understand the concept of multi rate Digital Signal Processing. (L1)
- Analyze the input and output spectrum of Decimation and Interpolation. (L4)

TEXTBOOKS:

1. "Digital Signal Processing, Principles, Algorithms, and Applications", John G. Proakis, Dimitris G. Manolakis, Pearson Education, 2007.
2. "Discrete Time Signal Processing", A.V. Oppenheim and R.W. Schaffer, PHI.
3. "Digital Signal Processing", Avtar Singh and S. Srinivasan, Thomson Publications, 2004.

REFERENCE BOOKS:

1. "Digital Signal Processing – A practical approach", S. K. Mitra, Pearson Education, New Delhi, 2nd Edition, 2004.
2. "Digital Signal Processing, Schaum's Outline series", MH Hayes, Tata Mc-Graw Hill, 2007.
3. "Fundamentals of Digital Signal Processing using Matlab", Robert J. Schilling, Sandra L. Harris, Thomson, 2007.
4. "Digital Signal Processors, Architecture, Programming and Applications", B. Venkata Ramani and M. Bhaskar, TMH, 2004.

Course Code	MODERN POWER ELECTRONICS		L	T	P	C
21A020436			3	0	0	3
Pre-requisite	Power Electronics	Semester	VII			

COURSE OBJECTIVES:

- Understand Principle of Operation Advanced Power Converters.
- Describe the operation of multi level inverters with switching strategies for high power applications.
- Comprehend the design of resonant converters and switched mode power supplies.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Principle of Operation Advanced Power Converters. **(K2)**
CO2: Develop and analyze various converter topologies. **(K5)**
CO3: Describe the operation of multi level inverters with switching strategies for high power applications. **(K3)**
CO4: Comprehend the design of resonant converters and switched mode power supplies. **(K3)**
CO5: Analyze the concept of bi-directional AC power supply **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

PWM Inverters: Principle of Operation – Performance Parameters – Single Phase Bridge Inverter – Output Voltage and Current With R, R-L & R-L-C Loads – Voltage Control of Single Phase Inverters – Advanced Modulation Techniques for Improved Performance –Numerical Problems.

Three Phase Inverters –180 Degree Condition –120 Degree Conduction – Analysis – Output Voltage and Current With R, R-L & R-L-C Loads – Voltage Control of Three Phase Inverters – Comparison of PWM Techniques – Harmonic Reductions – Current Source Inverter – Variable DC Link Inverter – Buck and Boost Inverter – Inverter Circuit Design – Applications – Numerical Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the operation of CSI and VSI.(L2)
- Understand the operation of Buck-Boost Inverters.(L2)

UNIT – II (9 Hrs)

Resonant Pulse Inverters: Series Resonant Inverters – Analysis with Unidirectional Switches & Bidirectional Switches – Evaluation of Currents and Voltages – Frequency Response of Series Resonant Inverters – Series Loaded Inverter –Parallel Loaded Inverter –Series and Parallel Loaded Inverters – Parallel Resonant Inverters – Voltage Control of Resonant Inverters – Class E Resonant Inverter & Class E Resonant Rectifier – Numerical Problems.

Resonant Converters – Zero Current Switching Resonant Converters – L Type– M Type – Zero Voltage Switching Resonant Converters – Comparison Between ZCS And ZVS – Resonant Converters – Two Quadrant ZVS Resonant Converters – Resonant DC-Link Inverters – Numerical Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of frequency response of series resonant inverters.(L2)
- Compare the ZCS and ZVS Resonant Converters.(L3)

UNIT – III (9 Hrs)

Multilevel Inverters: Multilevel Concept – Types of Multilevel Inverters – Diode Clamped Multilevel Inverter – Improved Diode Clamped Inverter – Flying Capacitors Multilevel Inverter – Cascaded Multilevel Inverter– Principle Of Operation – Main Features– Applications – Reactive Power Compensation, Back to Back Intertie System, Adjustable Drives– Switching Device Currents – DC Link Capacitor Voltage Balancing – Features of Multilevel Inverters – Comparisons of Multilevel Converters – Numerical Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Multi Level Inverters.(L2)
- Compare the operation of Multilevel Converters.(L3)

UNIT – IV (9 Hrs)

DC Power Supplies : DC Power Supplies – Types – Switched Mode DC Power Supplies – Fly Back Converter –Forward Converter – Push-Pull Converter – Half Bridge Converter – Full Bridge Converter –Resonant DC Power Supplies – Bidirectional Power Supplies – Applications – Numerical Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Fly back Converters.(L2)
- Analyze the applications of Resonant DC Power Supplies.(L4)

UNIT – V (9 Hrs)

AC Power Supplies: AC Power Supplies – Types – Switched Mode Ac Power Supplies – Resonant AC Power Supplies – Bidirectional Ac Power Supplies – Multistage Conversions – Control Circuits – Power Line Disturbances – Power Conditioners – Uninterruptible Power Supplies – Applications – Numerical Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Bi Directional AC Power Supplies.(L2)
- Analyze the operation of UPS and its applications.(L4)

TEXTBOOKS:

1. "Power Electronics", Mohammed H. Rashid, Pearson Education, 3rd Edition.
2. "Fundamentals of Power Electronics", Robert Warren Erickson and Dragan Maksimovic, Springer US, 2nd Edition, 2001.

Course Code	HVDC & FACTS		L	T	P	C
21A020437			3	0	0	3
Pre-requisite	Power Electronics	Semester	VII			

COURSE OBJECTIVES:

- High voltage DC transmission systems
- Flexible AC transmission systems
- Various configurations of the above, Principle of operation, Characteristics of various FACTS devices

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the various HVDC concepts. **(K3)**
CO2: Analyze the HVDC Links and its configurations. **(K4)**
CO3: Analyze the DC Link power flow control. **(K4)**
CO4: Describe the basic operating principles of various flexible AC systems **(K3)**
CO5: Apply various FACT controllers in the power system **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO5	3	2	1	-	2	2	1	-	-	-	-	-	3	2

UNIT – I (9 Hrs)

Introduction: Electrical Transmission Networks, Conventional Control Mechanisms-Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase-Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS.

Learning Outcomes: At the end of the module, the learners will be able to

- Know about difference between HVDC and FACTS (L2)
- Know about limitations of conventional transmission systems(L2)
- Know about recent developments in Power Electronic switching devices(L2)

UNIT – II (9 Hrs)

High Voltage DC Transmission–I: Types of HVDC links - Monopolar, Homopolar, Bipolar and Back-to-Back, Advantages and disadvantages of HVDC Transmission, Analysis of Greatz circuit, Analysis of bridge circuit without overlap, Analysis of bridge with overlap less than 600, Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link.

Learning Outcomes: At the end of the module, the learners will be able to

- To learn about various HVDC link configurations(L3)
- To develop equivalent circuit of HVDC link(L3)

UNIT – III (9 Hrs)

High Voltage DC Transmission–II: Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing-angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

Learning Outcomes :At the end of the module, the learners will be able to

- To learn about various DC link control techniques . (L3)
- To learn about starting, stopping and reversal of power flow in DC links. (L3)

UNIT – IV (9 Hrs)

Flexible AC Transmission Systems-I: Types of FACTS Controllers, brief description about various types of FACTS controllers, Operation of 6-pulse converter, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation, principle of operation of various types of Controllable shunt Var Generation, Principle of switching converter type shunt compensator, principles of operation of various types of Controllable Series VAR Generation, Principle of Switching Converter type series compensator.

Learning Outcomes: At the end of the module, the learners will be able to

- To understand principle of working and differences between various pulse configurations of various converters. (L2)
- To understand the necessity of compensators. (L2)
- To analyze the configurations of shunt, VAR, series configurations, etc.(L3)

UNIT – V (9 Hrs)

Flexible AC Transmission Systems-II: Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control; Interline Power Flow Controller (IPFC) – Principle of operation and Characteristics, UPFC and IPFC control structures (only block diagram description), objectives and approaches of voltage and phase angle regulators.

Learning Outcomes: At the end of the module, the learners will be able to

- To know more about advanced Power flow controllers. (L2)
- To analyze the transmission control strategies. (L2)
- To know about voltage and phase regulators. (L2)

TEXTBOOKS:

1. "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", Narain G. Hingorani and Laszlo Gyugyi, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. "Direct current transmission, Vol. I", E.W. Kimbark, Wiley Inter science, New York, 1971.

REFERENCE BOOKS:

1. "FACTS Controllers in Power Transmission and Distribution", K R Padiyar, New Age International Publishers, New Delhi, 2007.
2. "FACTS: Modelling and Simulation in Power Networks", Anrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles-Camacho, John Wiley & Sons, West Sussex, 2004.

Course Code	MANAGEMENT SCIENCE (Common to all Branches)		L	T	P	C
21A110204			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training& Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concepts and principles of management in real life industry. And students can be able to design and develop organization chart and structure for an enterprise. **(K3)**

CO2: Apply operations management techniques in real life industry. **(K3)**

CO3: Apply the concepts of HRM in Recruitment, Selection, Training & Development. **(K3)**

CO4: Develop PERT/CPM charts for projects of an enterprise and estimate time & cost of a project and to develop Mission, Objectives, Goals & Strategies for an enterprise in dynamic environment. **(K3)**

CO5: Understand & apply modern management techniques wherever possible. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	3	-	-	-

UNIT – I (9 Hrs)

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of management and organization (L2)
- Apply the concepts & principles of management in real life industry (L3)
- Analyze the organization chart & structure for an enterprise.(L4)
- Evaluate and interpret the theories and the modern organization theory (L5)

UNIT – II (10 Hrs)

Operations Management: Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management** - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the core concepts of Management Science and Operations Management (L2)
- Apply the knowledge of Quality Control, Work-study principles in real life industry (L3)
- Evaluate Materials departments & Determine EOQ (L5)
- Analyze Marketing Mix Strategies for an enterprise (L4)
- Create and design advertising and sales promotion (L5)

UNIT – III (6 Hrs)

HUMAN RESOURCES MANAGEMENT: HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development (L2)
- Apply Managerial and Operative Functions (L3)
- Analyze the need of training (L4)
- Evaluate performance appraisal (L5)
- Design the basic structure of salaries and wages (L5)

UNIT – IV (12 Hrs)

Strategic & Project Management: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and

Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

Learning Outcomes: At the end of this unit, students should be able to

- Understand Mission, Objectives, Goals & Strategies for an enterprise (L2)
- Apply SWOT Analysis to strengthen the project (L3)
- Analyze Strategy formulation and implementation (L4)
- Evaluate PERT and CPM Techniques (L5)
- Create in competing the projects within given time (L5)

<u>UNIT – V</u> (8 Hrs)

Contemporary Issues in Management: The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand modern management techniques (L2)
- Apply Knowledge in modern management (L3)
- Analyze CRM, TQM (L4)
- Evaluate Six Sigma concept and SCM (L5)

<u>TEXTBOOKS:</u>

1. “Management Science”, A.R Aryasri, TMH, 2013
2. “Management”, Stoner, Freeman, Gilbert, Pearson Education, New Delhi, 2012.

<u>REFERENCE BOOKS:</u>

1. “Essentials of Management”, Koontz &Weihrich, TMH, 6th Edition, 2005.
2. “Management Principles and Guidelines”, Thomas N. Duening & John M. Ivancevich, Biztantra.
3. “Production and Operations Management”, Kanishka Bedi, Oxford University Press, 2004.
4. “Modern Management”, Samuel C. Certo, 9th Edition, PHI, 2005

Course Code	IOT APPLICATIONS IN ELECTRICAL ENGINEERING		L	T	P	C
21A020702			1	0	2	2
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand basics of Internet of Things and Micro Electro Mechanical Systems (MEMS)
- fundamentals in design and fabrication process
- Analyze motion less and motion detectors in IoT applications
- Understand about Analyze applications of IoT in smart grid
- Apply the concept of Internet of Energy for various applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concept of IoT in Electrical Engineering.**(K2)**

CO2: Analyze various types of motionless sensors and various types of motion detectors. **(K4)**

CO3: Apply various applications of IoT in smart grid.**(K3)**

CO4: Design future working environment with Energy internet.**(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	2	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	2	-	-	-	-	-	1	-	-
CO4	3	3	3	2	-	2	-	-	-	-	-	-	-	-

Module – I: IOT Introduction

What is an IoT - Architecture of IoT - What is Arduino / Node MCU / Raspberry, pin Configurations, Introduction to Arduino IDE

Practice:

1. Introduction to Arduino/Esp32, Introduction to raspberry Pi.

Module – II: IOT Sensors

Light sensor, Ultrasonic sensor, Temperature sensor, Knock Sensor, Object Detection Sensor, Metal Touch Sensor, Water Level Sensor, Vibration Sensor, Air Pressure sensor, Motors, Types of Motors, Ultrasonic Sensor, Soil moisture sensor ,LCD's

Practice:

1. Measurement of temperature & pressure values of the process using raspberry pi/node mcu/esp32.
2. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu /esp32.
3. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu/ /esp32.

<u>Module – III:</u> IoT Communication Technologies

Introduction to Open Systems Interconnection (OSI) model – Gateway – Cloud – Connectivity - Data processing - User interface – Bluetooth – RFID - Wireless Technologies.

Practice:

1. Demonstration of Bluetooth communication protocol

<u>Module – IV:</u> IoT Configuration

Elements of IoT: Hardware components – computing (Arduino/Raspberry Pi), communication, Sensing, Actuation, I/O interfaces Software Components. Programming API's.

Practice:

1. Assemble IoT hardware components with proper programming.

<u>Module – V:</u> Visualization and data types of IoT

Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT

Practice:

1. Visualization of diverse sensor data using dashboard (part of IoT's 'control panel')

<u>Module – VI:</u> Retrieving Data

Extraction from Web: Grabbing the content from a web page, sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M).

Practice:

1. Device control using mobile Apps or through Web pages.

Projects:

1. Home automation through IoT
2. Smart Electric Grid
3. Smart Agriculture system
4. Automation using controller via Bluetooth
5. Temperature controlled Fan/cooler using controller
6. Automatic streetlight
7. Smart Parking system
8. Automatic Energy Meter through IoT

TEXTBOOKS:

1. "Sensor Technology Hand book", Jon S. Wilson, Newnes Publisher, 2004
2. "MEMS and Microsystems: Design and manufacture", Tai Ran Hsu, Mc Graw Hill Education, 1st Edition, 2017
3. "From Smart grid to Internet of Energy", Ersan Kabalci and Yasin Kabalci, Academic Press, 1st Edition, 2019

REFERENCE BOOKS:

1. "Internet of Things: Principles and Paradigms", Raj Kumar Buyya and Amir Vahid Dastjerdi, Morgan Kaufmann Publisher, Kindle Edition, 2016
2. "Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management", Yen Kheng Tan and Mark Wong, 1st Edition, CRC Press, 2019
3. "Internet of Things", RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, Wiley, 2019

ONLINE LEARNING RESOURCES:

1. https://www.tutorialspoint.com/internet_of_things/index.htm
2. https://en.wikipedia.org/wiki/Industrial_internet_of_things
3. https://www.javatpoint.com/iot-internet-of-things
4. https://www.guru99.com/iot-tutorial.html

OPEN ELECTIVE – I

Course Code	AIR POLLUTION AND CONTROL		L	T	P	C
21A010501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To identify the sources of air pollution
- To know the composition and structure of atmosphere
- To know the pollutants dispersion models
- To understand the working of air pollution control equipment
- To identify the sources of noise pollution and their controlling methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the sources of air pollution. **(K2)**
CO2: Explain the composition and structure of atmosphere. **(K4)**
CO3: Discuss the general characteristics of stack emissions and their behavior. **(K2)**
CO4: Understand the mechanism of Control of air pollutants. **(K2)**
CO5: Know about the noise sources, mapping, prediction equations etc. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	-	-	-	3	1	-	-	-	-	3	1
CO2	3	1	3	-	-	-	3	1	-	-	-	-	1	1
CO3	3	2	2	-	-	-	3	1	-	-	-	-	2	2
CO4	3	1	2	-	-	-	3	1	-	-	-	-	1	1
CO5	3	2	2	-	-	-	3	1	-	-	-	-	1	2

UNIT – I (9 Hrs)

Introduction: sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance. Indoor Air Pollution– sources, effects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the character of atmospheric pollutants and their effect. (L4)

UNIT – II (9 Hrs)

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Wind rose diagram.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the composition and structure of atmosphere. (L4)
- Write the maximum mixing depth and windrose diagram. (L6)

UNIT – III (9 Hrs)

General characteristics of stack emissions, plume behavior, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources. Monitoring of particulate matter and gaseous pollutants –respirable, non-respirable and nano - particulate matter. CO, CO2, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

Learning Outcomes: At the end of this unit, students should be able to

- Express about the general characteristics of stack emissions and their behavior. (L6)
- Analyze the monitoring of particulate matter and gaseous pollutants. (L4)

UNIT – IV (9 Hrs)

Air Pollution Control equipment for particulate matter & gaseous pollutants– gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – Adsorption, Absorption, Scrubbers, Condensation and Combustion.

Learning Outcomes: At the end of this unit, student should be able to

- Explain the various air pollution control equipment. (L3)

UNIT – V (9 Hrs)

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the noise sources, mapping, prediction equations etc., (L5)

TEXTBOOKS:

1. "Air Pollution - Its Origin and Control", Wark K., Warner C.F., and Davis W.T, Harper & Row Publishers, New York.
2. "Environmental Engineering", H.S. Peavy, D.R. Row & G. Tchobanoglous, Mc Graw Hill International Edition

REFERENCE BOOKS:

1. "Air Pollution", Perkins H.C., McGraw Hill.
2. "Air Pollution Control Theory", Crawford M., TATA McGraw Hill.
3. "Air Pollution", Stern A.C., Volume I, II, III.
4. "Air Pollution", Seinfeld N.J., McGraw Hill.
5. "Air Quality Management", Stern A.C., Volume V.
6. "Air Pollution", M N Rao and HVN Rao, Tata McGraw Hill publication

ONLINE LEARNING RESOURCES:

1. http://www.epa.gov
2. http://www.indiaenvironmentportal.org.in
3. http://nptel.iitm.ac.in
4. http://www.filtersource.com

Course Code	ROBOTICS		L	T	P	C
21A030501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control
- To choose and incorporate robotic technology in engineering systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the introduction and types of robots. **(K2)**

CO2: Analyze kinematics using forward and inverse kinematics and dynamics of robots using transformation, Jacobians, Lagrange – Euler and Newton – Euler formation. **(K4)**

CO3: Understand the working principle of different types of actuators and sensors. **(K2)**

CO4: Understand the motion types and robot programming software. **(K2)**

CO5: Know importance of robotic Applications in manufacturing. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	1	-	-	-	-	-	-	2	3	-
CO2	1	-	3	-	-	-	-	-	-	-	-	1	1	3
CO3	3	-	2	-	2	-	-	-	-	-	-	1	3	1
CO4	3	-	2	-	3	-	-	-	-	2	-	-	3	2
CO5	3	-	2	-	2	-	-	-	-	1	-	2	3	-

UNIT – I (8 Hrs)

Introduction to Industrial Robots: Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of robots. (L2)
- Differentiate types of robots and robot grippers. (L4)

UNIT – II (8 Hrs)

Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation-D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformation, Jacobians .Lagrange – Euler and Newton – Euler formations.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire the knowledge about robot kinematics and dynamics. (L2)

- Analyze the forward and inverse kinematics of robot manipulators. (L4)

UNIT – III (9 Hrs)
Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile sensors, Proximity sensors.
Learning Outcomes: At the end of this unit, students should be able to

- Identify the various types of robot actuators and feedback components. (L1)
- Understand the working of robot sensors. (L2)

UNIT – IV (11 Hrs)
Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion.
Robot programming - Types – features of languages and software packages.
Learning Outcomes: At the end of this unit, students should be able to

- Analyze motion in links and joints of a robot. (L4)
- Understand the types and software packages of robots. (L2)

UNIT – V (9 Hrs)
Robot Application in Manufacturing: Material Transfer -Material handling, loading and unloading - Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.
Learning Outcomes: At the end of this unit, students should be able to

- Express the various applications of robots in industries. (L2)
- Acquire the knowledge about real time applications of robots in manufacturing. (L2)

TEXTBOOKS:

1. "Industrial Robotics", M.P. Groover, TMH.
2. "Robotics, Fundamental Concepts and analysis", Ashitave Ghosal, Oxford Press
3. "Robotics and Control", Mittal R K & Nagrath I J, TMH.

REFERENCE BOOKS:

1. "Robotics", Fu K S, McGraw Hill.
2. "An Introduction to Robot Technology", P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. "Robotic Engineering", Richard D. Klafter, Prentice Hall
4. "Introduction to Robotics", John J. Craig, Pearson Edu
5. "Automation, Production systems and CIM", M.P. Groover, Pearson Edu

Course Code	BASICS OF MECHANICAL ENGINEERING		L	T	P	C
21A030502			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize students with basic power plants types, turbines, pumps, IC engines, boilers, refrigeration and air conditioning process and their performance aspects.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know types of power generating plants by using conventional or Non-conventional resources. **(K2)**
CO2: Understand and implementation of turbines, explain different types of pumps and their application. **(K2)**
CO3: Describe To familiarize the developments in IC engines. **(K2)**
CO4: Uunderstand the concept of the boilers. **(K2)**
CO5: Explain the working principles of refrigeration and air conditioning systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	2	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-	-	2	-	-

UNIT – I (10 Hrs)

Power Plant Engineering: Introduction – Energy Renewable and Non – Renewable Energy, Sources – Classification of Power Plants based on Sources of Energy – Thermal Power Plant or Steam Power Plant – Hydro Electric Power – Nuclear Fission, Chain Reaction, Layout of Nuclear Power Plant – Diesel Power Plant – Gas Turbine Power Plant – Open Cycle Gas Turbine, Closed Cycle Gas Turbine Power Plant, Comparison of Diesel Power Plant with Gas Turbine Power Plant.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the energy Renewable and Non – Renewable Energy Sources. (L2)
- Illustrate the working principle of Steam, Nuclear & open cycle, and closed cycle gas turbine. (L2)

UNIT – II (10 Hrs)

Hydraulic Turbine – Classification of Hydraulic Turbines, Impulse Turbine, Reaction Turbine, Difference between Impulse and Reaction Turbine.

Pumps – Classification of Pumps, Centrifugal Pump, Applications of Centrifugal Pump, Priming, Reciprocating Pumps, Single Acting Reciprocating Pump, Working of a Double acting Reciprocating Pump, Comparison of Reciprocating Pump with Centrifugal Pump.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Hydraulic Turbines, Impulse Turbine, and Reaction Turbine. (L2)
- Understand the working of Centrifugal Pump, Reciprocating Pumps and Comparison between them. (L2)

UNIT – III (10 Hrs)

I.C Engine: Heat Engine – Types of Heat Engine – External Combustion Engine, IC Engine (Internal Combustion), Classification of I.C. Engine, Two Stroke Petrol Engine, Four Stroke Engine, Valve Timing Diagram, Port Timing Diagram, Comparison of Two Stroke and Four Stroke Engines, Comparison of Petrol Engine and Diesel Engine, Fuel System of a Petrol Engine, Ignition Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of External Combustion Engine, IC Engine. (L2)
- Illustrate the working of Two Stroke Petrol Engine, Four Stroke Engine. (L2)

UNIT – IV (7 Hrs)

Boilers: Classification of Boilers – Simple Vertical Boiler – Cochran Boiler – Babcock and Wilcox Boiler – Benson Boiler – Difference between Fire Tube and Water Tube Boilers – Boiler Mountings – Boiler Accessories – Difference between Boiler Mountings and Accessories.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of different types Fire Tube and Water Tube Boilers.(L2)

UNIT – V (8 Hrs)

Refrigeration and Air Conditioning: Introduction – Terminology of Refrigeration and Air Conditioning – Properties of Refrigerants – List of Commonly used Refrigerants – Types of Refrigerating System – Vapour Compression Refrigeration System – Vapour Absorption Refrigerator – Domestic Refrigerator – Air Conditioning – Application of Air Conditioning –Psychrometry – Window Air Conditioning.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Vapour Compression Refrigeration System – Vapour Absorption Refrigeration system. (L2)
- Illustrate the working of Air Conditioning. (L2)

TEXTBOOKS:

1. "Basic Civil and Mechanical Engineering", Er. R. Vaishnavi, Prof. V. Vijayan, Prof. M. Prabhakaran, S. Chand Publication, 2nd Edition
2. "Elements of Mechanical Engineering", S Trymbaka Murthy, University Press, 4th Edition

REFERENCE BOOKS:

1. "Elements of Mechanical Engineering", S. N. Lal, Cengage Learning, 2013
2. "Elements of Mechanical Engineering", S. Trymbaka Murthy, Universities Press, 2015
3. "Mechanical Technology", Dr M. Maruthi Rao and V. Pavan Kumar, Lambert Academic Publishing, 2022

Course Code	INTEGRATED CIRCUITS AND APPLICATIONS		L	T	P	C
21A040501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To introduce the basic building blocks of linear integrated circuits.
- To impart knowledge on linear and non-linear applications of Op-Amps.
- To design various circuits using Op-Amps.
- To familiarize with specialized ICs such as 555 timer and voltage regulators.
- To familiarize with digital ICs.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the construction and characteristics of Operational Amplifier IC **(K2)**
CO2: Explain various linear & non-linear applications of Op-amp **(K2)**
CO3: Develop knowledge on filters and describe internal circuit operation of 555 timer and voltage regulators ICs **(K3)**
CO4: Summarize combinational circuits using Digital integrated circuits **(K3)**
CO5: Explain the internal structure of sequential Digital integrated circuits **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	3	1	-
CO2	2	2	2	1	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	1	-	-	-	-	-	-	-	3	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	1	-

UNIT – I (8 Hrs)

INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER: Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of IC & classifications (L2)
- Understand the concepts of Operational amplifier. (L2)
- Illustrate the internal circuit of operational amplifier (L2)
- Analyze DC & AC characteristics of op-amp (L4)

UNIT – II (10 Hrs)

LINEAR APPLICATIONS OF OP-AMP: Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveformgenerators, Oscillators

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of integrator & differentiator circuits (L2)
- Understand the concepts of multivibrators and waveform generators (L2)
- Develop the output voltage expression for instrumentation amplifier (L3)
- Analyze the adder, subtractors, multiplier and divider circuits (L4)

UNIT – III (10 Hrs)

ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

TIMERS AND REGULATORS: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, Introduction-Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on 1st and 2nd order active filters. (L3)
- Understand the functionality of 555 timer. (L2)
- Understand the internal structure and functionality of voltage regulators (L2)

UNIT – IV (8 Hrs)

COMBINATIONAL CIRCUITS USING TTL 74XX ICS: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7- segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on the working of various combinational circuit ICs. (L3)
- Develop higher order combinational circuits from lower order Combinational ICs. (L3)

UNIT – V (9 Hrs)

SEQUENTIAL CIRCUITS USING TTL 74XX ICS: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493), Memory -SRAM & DRAM.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of sequential circuits using TTL ICs. (L2)

- Develop higher order Sequential circuits from lower order Sequential ICs. (L3)

TEXTBOOKS:

1. "Linear Integrated Circuit", D. Roy Choudhury, Shail B. Jain, New Age International Pvt.Ltd., New Delhi, India, 4th Edition, 2012
2. "OP-AMP and Linear Integrated Circuits", Ramakant A. Gayakwad, Prentice Hall / Pearson Education, New Delhi, 4th Edition, 2012
3. "Digital Fundamentals", Floyd, Jain, Pearson Education, New Delhi, 8th Edition, 2009.

REFERENCE BOOKS:

1. "Design with operational amplifiers and analog integrated circuits", Sergio Franco McGrawHill, New Delhi, 1997
2. "Digital Design Principles and Practices", John F Wakerly, Pearson Education, 4th Edition

Course Code	INTRODUCTION TO SIGNAL PROCESSING		L	T	P	C
21A040502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- To represent continuous time signals (both periodic and non-periodic) in the time domain, s-domain and the frequency domain.
- To understand the properties of analog filters, and have the ability to design Butterworth filters.
- To understand and apply sampling theorem and convert a signal from continuous time to discrete time and able to represent the discrete time signal in the frequency domain.
- To understand FIR and IIR filters to meet given specifications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain continuous time and discrete time signals and systems, in time and frequency domain. **(K3)**

CO2: Apply Fourier series and Fourier Transform to analyze periodic & non-periodic signals and their spectra. **(K3)**

CO3: Design and implement the analog filter using components/suitable simulation tools. **(K4)**

CO4: Apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time. **(K3)**

CO5: Design and implement the digital filter using suitable simulation tools. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3		-	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	3	3		-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction to Signals & Systems: Signal Definition, Signal Classification, System definition, System classification for both continuous time and discrete time, Basic Operations on Signals, Elementary Signals & Sequences, Definition of LTI systems, Transfer function of a LTI system, Concepts of Convolution and Correlation of signals, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different basic types of signals and systems. (L2)

- Understand various basic operations on signals and elementary signals. (L2)
- Describe continuous time signal and discrete time signal. (L2)
- Sketch the various types of basic signals for both continuous time & discrete time. (L3)
- Understand the LTI systems, convolution & correlation of signals. (L2)

UNIT – II (10 Hrs)

Fourier Series & Transform: Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems, Fourier Transform of arbitrary signal, Properties of Fourier Transform, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the periodic signals by applying Fourier series. (L4)
- Apply Fourier transform to solve problems. (L3)
- Analyze the spectral characteristics of signals. (L4)

UNIT – III (8 Hrs)

Analog Filters: Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of analog filters. (L2)
- Design and implement the analog Butterworth filters. (L4)

UNIT – IV (8Hrs)

Sampling Theorem & DFT: Sampling Theorem- Statement and proof, converting the analog signal to a digital signal, Practical sampling, The Discrete Fourier Transform, Properties of DFT, IDFT, Comparing the frequency response of analog and digital systems, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of sampling techniques. (L2)
- Illustrate signal sampling and its reconstruction. (L3)
- Explain the importance of discrete Fourier transform. (L3)

UNIT – V (10Hrs)

Digital Filters: Characteristics of FIR and IIR filters. Frequency response of ideal digital filters, Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, Comparison of FIR & IIR, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of IIR and FIR digital Filters. (L2)
- Analyze windowing techniques in FIR filters. (L4)

- Illustrate the digital filters of different techniques. (L3)
- Design IIR and FIR filters. (L4)

TEXTBOOKS:

1. "Signals, Systems and Communications", B. P. Lathi, BS Publications, 2008.
2. "Digital signal processing, principles, Algorithms and applications", John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 4th Edition, 2007.
3. "Discrete Time Signal Processing", A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

REFERENCE BOOKS:

1. "Linear Systems and Signals", B. P. Lathi, Oxford University press, 2nd Edition.
2. "Digital Signal Processing – Fundamentals and Applications", Li Tan, Elsevier, 2008.
3. "Signals, Systems and Transforms", C. L. Philips, J. M. Parr and Eve A. Riskin, PE, 3rd Edition, 2004.
4. "Signals and Systems", A.V. Oppenheim, A.S. Willsky and S. H. Nawab, PHI, 2nd Edition, 2013.
5. "Signals and Systems", A. Anand Kumar, PHI Publications, 3rd Edition, 2013.

Course Code	OPERATING SYSTEMS CONCEPTS		L	T	P	C
21A050501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To gain knowledge about the Operating Systems concepts such as process, main memory management, secondary memory management, CPU and disk scheduling etc.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the general architecture of computers **(K2)**
CO2: Describe, contrast and compare differing structures for operating Systems. **(K3)**
CO3: Analyse theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files. **(K4)**
CO4: Understand paging mechanism, virtual memory **(K2)**
CO5: Understand and identify the dead lock and methods to recovery the dead lock **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	2	1	-	-	-	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-	-	-
CO4	3	2	2	2	-	2	-	-	2	-	-	-	-	1
CO5	3	2	2	2	-	2	-	-	2	-	-	-	-	1

UNIT – I (9 Hrs)

Computer System and Operating System Overview: Overview of computer operating systems, operating systems functions, protection and security, distributed systems, special purpose systems, operating systems structures and systems calls, operating systems generation.

Learning Outcomes: At the end of this unit, students should be able to

- Identify major components of operating systems. (L1)
- Understand the types of computing environments. (L2)
- Explore several open-source operating systems. (L4)
- Recognize operating system services to users, processes and other systems. (L2)

UNIT – II (10 Hrs)

Process Management – Process concept- process scheduling, operations, Inter process communication. Multi Thread programming models. Process scheduling criteria and algorithms, and their evaluation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance, features of a process and methods of communication between processes. (L2)
- Examine CPU utilization through multi programming and multithreaded programming. (L3)

UNIT – III (8 Hrs)

Concurrency: Process synchronization, the critical- section problem, Peterson's Solution, synchronization Hardware, semaphores, classic problems of synchronization, monitors, Synchronization examples.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the various Problems of Process Synchronization. (L3)

UNIT – IV (8 Hrs)

Memory Management: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation Virtual Memory Management: virtual memory, demand paging, page-Replacement, algorithms, Allocation of Frames, Thrashing.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the various techniques of allocating memory to processes. (L3)
- Summarize how paging works in contemporary computer systems. (L4)
- Understanding the benefits of virtual memory systems. (L2)

UNIT – V (10 Hrs)

Principles of deadlock– system model, deadlock characterization, deadlock prevention, detection and avoidance, recovery form deadlock.

Learning Outcomes: At the end of this unit, students should be able to

- Investigate methods for preventing/avoiding deadlocks. (L4)
- Examine file systems and its interface in various operating systems. (L3)

TEXTBOOKS:

1. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, John Wiley, 7th Edition.
2. "Operating Systems – Internal and Design Principles", Stallings, Pearson education, 6th Edition, 2005.

REFERENCE BOOKS:

1. "Operating systems- A Concept based Approach", D. M. Dhamdhere, 2nd Edition, Tata McGraw Hill
2. "Operating System – A Design Approach", Crowley, TMH.

3. "Modern Operating Systems", Andrew S Tanenbaum, 3rd Edition, Prentice Hall International.

ONLINE LEARNING RESOURCES:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/Operating%20Systems/New_index1.html

<table>
<tr><td>Course Code</td><td rowspan="2" colspan="2">COMPUTER ARCHITECTURE & ORGANIZATION</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A050502</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">V</td></tr>
</table>

COURSE OBJECTIVES:

- Principles and the Implementation of Computer Arithmetic
- Operation of CPUs including RTL, ALU, Instruction Cycle and Busses
- Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design
- Memory System and I/O Organization
- Principles of Operation of Multiprocessor Systems and Pipelining.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop a detailed understanding of computer systems **(K4)**

CO2: Cite different number systems, binary addition and subtraction, standard, floating-point, and micro-operations **(K3)**

CO3: Develop a detailed understanding of architecture and functionality of central processing unit **(K4)**

CO4: Exemplify in a better way the I/O and memory organization **(K3)**

CO5: Illustrate concepts of parallel processing, pipelining and inter processor communication. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating, Point Representation. Other Binary Codes, Error Detection Codes. Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Organization of Computers. (L2)
- Compare various Arithmetic Algorithms. (L5)

UNIT – II (10 Hrs)

Register Transfer Language and Micro operations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit. Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description.

Learning Outcomes: At the end of this unit, students should be able to

- Perform various functions using basic logical operations. (L5)
- Apply I/O and interrupts to execute various operations. (L4)

UNIT – III (8 Hrs)

Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Micro programmed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various addressing Modes. (L1)
- Compare various instruction formats. (L5)
- Design and other issues related to Control Unit. (L4)

UNIT – IV (8 Hrs)

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.

Learning Outcomes: At the end of this unit, students should be able to

- Compare various memories. (L3)
- Analyze various modes of transfer. (L5)

UNIT – V (8 Hrs)

Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration.

Pipeline: Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

Learning Outcomes: At the end of this unit, students should be able to

- Analyzing various processors. (L5)
- Compare various Pipeline. (L4)

TEXTBOOKS:

1. "Computer System Architecture", M. Morris Mano, Pearson, 3rd Edition, 2008.
2. "Computer Organization", Carl Hamacher, Zvonko Vranesic, Safwat Zaky, McGraw Hill, 5th Edition, 2002.

REFERENCE BOOKS:

1. "Computer Organization and Architecture", William Stallings, Pearson, 6th Edition, 2006.
2. "Structured Computer Organization", Andrew S. Tanenbaum, Pearson, 4th Edition, 2005.
3. "Fundamentals of Computer Organization and Design", Sivarama P. Dandamudi, Springer, 2006.

ONLINE LEARNING RESOURCES:

1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

OPEN ELECTIVE – II

Course Code	ENVIRONMENTAL POLLUTION AND CONTROL		L	T	P	C
21A010502			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart knowledge on aspects of air pollution & control and noise pollution.
- To impart concepts of treatment of waste water from industrial source.
- To differentiate the solid and hazardous waste based on characterization.
- To introduce sanitation methods essential for protection of community health.
- To provide basic knowledge on sustainable development.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the fundamentals of solid waste management, practices adopted in his town / village and its importance in keeping the health of the city. **(K2)**

CO2: Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards**. (K2)**

CO3: Differentiate the treatment techniques used for sewage and industrial wastewater Treatment. **(K3)**

CO4: Integrate the methods of environmental sanitation and the management of community facilities without spread of epidemics. **(K6)**

CO5: Appraise the importance of sustainable development while planning a project or executing an activity. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

AIR POLLUTION:

Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

Learning Outcomes: At the end of this unit, students should be able to

- Understand control mechanism of air pollutants. (L2)
- Design noise reduction techniques. (L6)

UNIT – II (9 Hrs)

INDUSTRIAL WASTE WATER MANAGEMENT:

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of treatment process of industrial effluents. (L2)
- Design treatment plants. (L6)

UNIT – III (9 Hrs)

SOLID WASTE MANAGEMENT: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

HAZARDOUS WASTE: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Learning Outcomes: At the end of this unit, students should be able to

- Categorize of solid waste and separation and procession solid waste. (L4)
- Estimate Hazardous wastes. (L5)
- Develop execute solid waste and hazardous waste management. (L6)

UNIT – IV (9 Hrs)

ENVIRONMENTAL SANITATION: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of hygienic environment. (L2)
- Choose appropriate rural sanitation methods to keep surrounding clean. (L5)

UNIT – V (9 Hrs)

SUSTAINABLE DEVELOPMENT: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability– Industrialization and sustainable development – Cleaner production in achieving sustainability-sustainable
development.

Learning Outcomes: At the end of this unit, students should be able to

- Express sustainable development strategies. (L6)

TEXTBOOKS:

1. "Environmental Engineering", Peavy, H. S., Rowe, D.R, Tchobanoglous, Mc-Graw Hill International Editions, New York 1985.
2. "Environmental Science and Engineering", J. G. Henry and G. W. Heinke, Pearson Education.

REFERENCE BOOKS:

1. "Waste water treatment- concepts and design approach", G. L. Karia and R.A. Christian, Prentice Hall of India
2. "Air pollution", M. N. Rao and H. V. N. Rao, Tata Mc.Graw Hill Company.
3. "Weiner and Robin Matthews Environmental Engineering", Ruth F., Elesevier, 4th Edition, 2003.
4. "Air Pollution and Control", K. V. S. G. Murali Krishna, Kousal & Co. Publications, New Delhi.

Course Code	AUTOMATION IN INDUSTRIES		L	T	P	C
21A030503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need of automation
- Classify various types of automated transmission lines and components of automation.
- List and understand various material handling systems.
- Design various types of automated assembly systems
- Explain various automatic inspection systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand principles and basic elements of automation. **(K2)**
CO2: Understand the Detroit automation and automated flow lines. **(K2)**
CO3: Learn the material handling technology and assembly systems. **(K1)**
CO4: Learn the control systems technology and its process in automation. **(K1)**
CO5: Understand the inspection, testing and PLC's in automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	3	1	2	1	-	-	-	-	-
CO2	3	-	-	-	2	2	1	-	2	-	-	-	-	-
CO3	3	-	-	-	1	1	1	-	1	-	-	-	-	-
CO4	2	2	3	-	3	2	2	-	2	-	-	-	-	-
CO5	2	-	-	-	2	1	2	-	1	-	-	-	-	-

UNIT – I (9 Hrs)

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break-Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in process.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the principles of production, investment, cost concepts in automation. (L2)

UNIT – II (10 Hrs)

Detroit-Type Automation: Automated Flow lines, Methods of Work-part Transport, Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations.

Analysis of Automated Flow Lines: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the types of automation method concepts and machining operations. (L2)

<u>UNIT – III</u> (11 Hrs)

Material handling and Identification Technologies: The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc.

Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multistation Assembly Machines, Analysis of a Single Station Assembly Machine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Apply the techniques of material handling and automated assembly systems. (L4)

<u>UNIT – IV</u> (7 Hrs)

Control Technologies in Automation: Industrial Control Systems, Process Industries Verses Discrete- Manufacturing Industries, Continuous Verses Discrete Control, Computer Process Control and its Forms. Computer Based Industrial Control: Introduction & Automatic Process Control, Building Blocks of Automation System: LAN, Analog & Digital I/O Modules, SCADA System & RTU.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the industrial control technologies in automation. (L2)

<u>UNIT – V</u> (8 Hrs)

Automated Inspection and Testing: Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods.

Programmable Logic Controllers (PLCs): Introduction, Micro PLC, Programming a PLC, Logic Functions, Input & Output Modules, PLC Processors, PLC Instructions, Documenting a PLC System, Timer & Counter Instructions, Typical PLC Programming Exercises for Industrial Applications.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain the inspection, testing methods and PLC’s methods in automation. (L2)

TEXTBOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing", M. P. Grover, Pearson Education.

REFERENCE BOOKS:

1. "Computer Based Industrial Control", Krishna Kant, EEE-PHI
2. "Principles and Applications of PLC", Webb John, Mcmillan 1992
3. "An Introduction to Automated Process Planning Systems", Tiess Chiu Chang & Richard A. Wysk
4. "Anatomy of Automation", Amber G.H & P.S. Amber, Prentice Hall.

Course Code	RAPID PROTOTYPING		L	T	P	C
21A030504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- The fundamental Theory behind RP process.
- Study the Process parameters of different machine.
- Study different types of Rapid tooling.
- Based on the industrial standards, learn how Prepare manufacturing DATA.
- The basics concept of different software used in RP system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Theory behind RP process. **(K2)**
CO2: Learn the Process parameters of different machine. **(K3)**
CO3: Learn different types of Rapid tooling. **(K3)**
CO4: Understand the industrial standards; learn how to prepare manufacturing Data. **(K2)**
CO5: Understand basics concept of different software used in RP system. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	2	3	1	2	-	-	1	-	-	-	-
CO2	2	2	-	3	2	2	2	-	-	1	-	-	-	-
CO3	3	2	-	3	2	1	3	-	-	1	-	-	-	-
CO4	1	2	-	3	3	1	3	-	-	1	-	-	-	-
CO5	1	2	-	3	3	1	3	-	-	1	-	-	-	-

UNIT – I (9 Hrs)

Introduction & History of Rapid Prototyping, Fundamentals of Rapid Prototyping, Advantages and Disadvantages of Rapid Prototyping, Applications of Rapid Prototyping, Classification of RP, Rapid prototyping process chain, Fundamental Automated processes.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the importance of rapid prototyping. (L1)
- Understand the concept of Stereo lithography. (L2)

UNIT – II (9 Hrs)

Stereo lithography (SLA) system & principle, Process parameter, process details of SLA, Data preparation, data files of SLA, Machine details & Application of SLA.

Selective Laser Sintering (SLS)- Introduction, SLS Machine Type – Details, SLS principle of operation, Process parameters of SLS, Data preparation for SLS.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about the selective laser sintering process. (L4)
- Explain about the concept of fused deposition modelling and solid ground curing. (L2)

UNIT – III (7 Hrs)

Fused Deposition Modeling (FDM) – Introduction, FDM Principles, Process Parameters, Path generation & Application of FDM, Solid Ground curing (SGC) - Principle of operation, SGC machine details & application. Laminate Object Manufacturing (LOM) - Principle of operation, LOM materials, LOM Process details & Application.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Demonstrate about laminated object manufacturing process. (L2)
- Know about different 3D modelling printing techniques. (L1)

UNIT – IV (10 Hrs)

Rapid tooling -Indirect rapid tooling, Silicon Rubber tooling, Aluminium filling epoxy tooling, Spray metal tooling, Direct rapid tooling, Quick cast process, copper Polyamide, DMILS – explanation, Prometals, sand casting tooling, Soft tooling & hard tooling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of rapid tolling. (L2)

UNIT – V (10 Hrs)

Rapid Manufacturing – Introduction, Factors influencing accuracy, Data preparation errors, Part building errors, Errors in finishing, Influence of build orientation.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand different file format software's of 3D modelling techniques. (L2)

TEXTBOOKS:

1. "Stereo lithography and other RP & M Technologies", Paul F. Jacobs, SME, NY 1996.
2. "Rapid Manufacturing", Flham D. T & Dinjoy S.S, Verlog London 2001.
3. "Rapid automated", Lament wood, Indus press New York.

REFERENCE BOOKS:

1. "Wohler's Report 2000", Terry Wohlers, Wohler's Association, 2000.
2. "Rapid prototyping materials", Gurumurthi, IISc Bangalore

Course Code	PRINCIPLES OF COMMUNICATION SYSTEMS		L	T	P	C
21A040503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

COURSE OUTCOMES:

At the end of this course, student will be able to

CO1: Apply the concept of amplitude modulation to solve engineering problems. **(K3)**
CO2: Analyze the Angle modulation & demodulation systems in time & frequency domains. **(K4)**
CO3: Analyze different Analog Pulse modulation & demodulation techniques. **(K4)**
CO4: Explain various digital modulation schemes. **(K3)**
CO5: Understand the concept of various communication systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Amplitude Modulation: An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of noise, Fourier transform, career modulation and frequency division multiplexing. (L2)
- Apply the concept of amplitude modulation to solve engineering problems. (L3)

UNIT – II (9 Hrs)

Angle Modulation: Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of angle modulation and its components. (L2)
- Apply the concept of frequency modulation to solve engineering problems. (L3)
- Analyse angle modulation schemes. (L4)
- Evaluate frequency modulation scheme in real time applications. (L4)

UNIT – III (8 Hrs)

Pulse Modulation: Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing. (L2)
- Explain various pulse modulation schemes. (L4)

UNIT – IV (9 Hrs)

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various digital modulation schemes. (L2)
- Analyze various digital modulation schemes. (L4)

UNIT – V (9 Hrs)

Communication Systems: Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various communication systems. (L2)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Principles of Communication Systems", Herbert Taub, Donald L Schilling and Goutam Saha, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

REFERENCE BOOKS:

1. "Modern Digital and Analog Communication Systems", B. P. Lathi, Zhi Ding and Hari M. Gupta, 4th Edition, Oxford University Press, 2017.
2. "Digital and Analog Communication Systems", K. Sam Shanmugam, Wiley India Edition, 2008.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108104091
2. https://www.eeeguide.com/principles-of-communication-systems
3. https://ncert.nic.in/ncerts/l/leph207.pdf

Course Code	ELECTRONIC INSTRUMENTATION		L	T	P	C
21A040504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To introduce various measuring instruments and their functionality.
- To teach various measurement metrics for performance analysis.
- To explain principles of operation and working of different electronic instruments.
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.
- To provide exposure to different types of transducers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the different methods for measurement of various electrical quantities. **(K2)**
CO2: Compare the various measuring techniques for measuring voltage. **(K4)**
CO3: Measure amplitude and frequency utilizing oscilloscopes. **(K5)**
CO4: Analyze the functioning of various types of probes, derive the balanced condition for various bridges. **(K4)**
CO5: Measure various physical parameters by appropriately selecting the transducers. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (10 Hrs)

Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. **Ammeters:** DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. **Voltmeters and Multi-meters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of measurement system. (L2)
- Explain the characteristics of different Instruments. (L2)

- Illustrate different types of errors that may occur in instruments during measurements. (L2)

UNIT – II (9 Hrs)

Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM.

Digital Instruments: Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

Learning Outcomes: At the end of this unit, students should be able to

- Explain working of digital measuring Instruments. (L2)
- Compare the various measuring techniques for measuring voltage. (L4)

UNIT – III (9 Hrs)

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope.

Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator.

Learning Outcomes: At the end of this unit, students should be able to

- Measure parameters viz. Amplitude, frequency and time period using CRO. (L5)
- Classify signal generators and describe its characteristics. (L2)

UNIT – IV (8 Hrs)

Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger.

Bridges: Introduction, Wheatstone‘s bridge, Kelvin‘s Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell‘s bridge, Wien‘s bridge.

Learning Outcomes: At the end of this unit, students should be able to

- Describe function of various measuring Instruments. (L2)
- Describe how unknown capacitance and inductance can be measured using bridges. (L2)
- Select appropriate bridge for measuring R, L and C parameters. (L2)
- Analyze the functioning of various types of probes derive the balanced condition for various bridges. (L4)

UNIT – V (9 Hrs)

Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of transducer. (L2)
- Measure various physical parameters by appropriately selecting the transducers. (L5)

TEXTBOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, McGraw Hill, 3rd Edition, 2012, ISBN: 9780070702066.
2. "Modern Electronic Instrumentation and Measuring Techniques", A. D. Helfrick and W.D. Cooper, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

REFERENCE BOOKS:

1. "Electronic Instrumentation & Measurements", David A. Bell, Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.
2. "Electronics and Electrical Measurements", A. K. Sawhney, Dhanpat Rai &Sons. ISBN - 81-7700-016-0

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/108105064/
2. http://nptel.ac.in/courses/108105062/

Course Code	JAVA PROGRAMMING		L	T	P	C
21A050503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Focus on object oriented concepts and java program structure and its installation.
- Comprehension of java programming constructs, control structures in Java.
- Implementing Object oriented constructs such as various class hierarchies, interfaces and exception handling.
- Understanding of Thread concepts and I/O in Java.
- Being able to build dynamic user interfaces using applets and Event handling in java.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use of objects to program. **(K3)**
CO2: Create programs by using Java basic Constructs. **(K3)**
CO3: Implement OOPs concepts. **(K3)**
CO4: Develop JAVA applets applications. **(K4)**
CO5: Apply multi-threaded concepts in programming. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	-	-	2	2	3	2	-	3	2
CO2	3	2	3	2	3	-	-	2	2	3	-	-	3	2
CO3	3	2	2	1	3	-	-	2	2	3	-	1	1	2
CO4	3	2	2	2	3	-	-	2	2	3	1	-	1	2
CO5	3	2	2	2	3	-	-	2	2	3	1	1	1	2

UNIT – I (8 Hrs)

Introduction to OOP: Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6

Learning Outcomes: At the end of this unit, students should be able to

- Understand the syntax, semantics and features of Java Programming Language. (L1)
- Compare Object Oriented and Procedural Languages. (L4)

UNIT – II (9 Hrs)

Programming Constructs: Variables, Primitive Data types, Identifiers- Naming Coventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules and

Associativity, Primitive Type Conversion and Casting, Flow of control- Branching, Conditional, loops. Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments.

Learning Outcomes: At the end of this unit, students should be able to

- Developing simple programs with java constructs. (L5)
- Learning about various Keywords in Java and their uses. (L1)

UNIT – III (9 Hrs)

Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class. Interfaces, Packages and Enumeration: Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages, using Packages, Access protection, java.lang package. Exceptions & Assertions – Introduction, Exception handling techniques- try catch, throw, throws, finally block, user defined exception.

Learning Outcomes: At the end of this unit, students should be able to

- Implement types of Inheritance and developing new classes based on existing classes. (L4)
- Distinguish between system packages and user defined packages. (L4)
- Demonstrate features of interfaces to implement multiple inheritances. (L3)
- Applying Exception in Programs where necessary. (L4)

UNIT – IV (6 Hrs)

Multi Threading: java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading-Synchronization, suspending and Resuming threads, Communication between Threads Input / Output: reading and writing data, java.io package

Learning Outcomes: At the end of this unit, students should be able to

- Understand concurrency, parallelism and multithreading. (L2)
- Create multitasking applications. (L5)

UNIT – V (9 Hrs)

Applets– Applet class, Applet structure, An Example Applet Program, Applet : Life Cycle, paint(), update() and repaint() Event Handling -Introduction, Event Delegation Model, java.awt. event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the GUI programming. (L2)
- Perform event Handling in java GUI Programs. (L5)

TEXTBOOKS:

1. "The Complete Reference Java", Herbert Schildt, TMH, 8th Edition

2. "Programming in JAVA", Sachin Malhotra, Saurabh choudhary, Oxford.
3. "JAVA for Beginners", Joyce Farrell, Ankit R. Bhavsar, Cengage Learning, 4th Edition.
4. "Object oriented programming with JAVA, Essentials and Applications", Raj Kumar Bhuyya, Selvi, Chu TMH.
5. "Introduction to Java Programming", Y Daniel Liang, Pearson, 7th Edition.

REFERENCE BOOKS:

1. "JAVA Programming", K. Rajkumar. Pearson.
2. "Core JAVA, Black Book", Nageswara Rao, Wiley, Dream Tech
3. "Core JAVA for Beginners", Rashmi Kanta Das, Vikas.
4. "Object Oriented Programming through JAVA", P Radha Krishna, University Press.

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/java/
2. https://www.javatpoint.com/java-tutorial

Course Code	BASICS OF DATABASE MANAGEMENT SYSTEMS		L	T	P	C
21A050504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Provides students with theoretical knowledge and practical skills in the use of databases.
- Database management systems in information technology applications.
- The logical design, physical design and implementation of relational databases are covered.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Define a Database Management System. **(K2)**
CO2: Compare the advantages and disadvantages of the different models. **(K4)**
CO3: Design Database using E-R Diagram (SQL). **(K4)**
CO4: Analyze the rules guiding transaction ACID properties. **(K4)**
CO5: Analyze file organization while storing and retrieving the data base **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	-	2	1	1	2	3	2
CO2	3	2	1	2	1	1	-	-	2	-	1	2	3	2
CO3	3	3	2	2	1	-	-	-	2	-	2	2	1	2
CO4	3	3	2	2	1	-	-	-	2	-	2	2	1	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	1	2

UNIT – I (10 Hrs)

INTRODUCTION: Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Data base systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between Database and File System. (L4)
- Categorize different kinds of data models. (L4)
- Define functional components of DBMS. (L2)

UNIT – II (8 Hrs)

RELATIONAL MODEL: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance **BASIC SQL:** Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

Learning Outcomes: At the end of this unit, students should be able to

- Outline the elements of the relational model such as domain, attribute, tuple, relation and entity. (L2)
- Distinguish between various kinds of constraints like domain, key and integrity. (L4)
- Define relational schema Develop queries using Relational Algebra and SQL. (L2)
- Perform DML operations on databases. (L4)

UNIT – III (8 Hrs)

ENTITY RELATION MODEL: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. **SQL:** Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations.

Learning Outcomes: At the end of this unit, students should be able to

- Develop E-R model for the given problem. (L4)
- Derive tables from E-R diagrams. (L4)

UNIT – IV (8 Hrs)

TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods: lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes, Database Recovery management : Transaction recovery. SQL constructs that grant access or revoke access from user or user groups. Basic PL/SQL procedures, functions and triggers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various properties of transaction. (L1)
- Design atomic transactions for an application. (L4)
- Gain the knowledge about log mechanism and check pointing techniques for system recovery. (L2)
- Create PLSQL programs and triggers for different database conditions. (L5)

UNIT – V (9 Hrs)

STORAGE AND INDEXING: Database file organization, file organization on disk, heap files and sorted files, hashing, single and multi-level indexes, dynamic multilevel indexing using B-Tree and B+ tree, index on multiple keys.

Learning Outcomes: At the end of this unit, students should be able to

- Understand file organization (L2)
- Compare various indexing techniques (L4)

TEXTBOOKS:

1. "Database Management Systems", Raghuram Krishnan, Johannes Gehrke, TMH, 3rd Edition
2. "Database Management System", Ramez Elmasri, Shamkant B. Navathe, PEA, 6th Edition
3. "Database Principles Fundamentals of Design Implementation and Management", Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

REFERENCE BOOKS:

1. "Database System Concepts", Silberschatz, Korth, TMH, 5th Edition
2. "Introduction to Database Systems", C J Date, PEA, 8th Edition

WEBLINKS

1. https://www.javatpoint.com/dbms-tutorial
2. https://www.geeksforgeeks.org/dbms/

OPEN ELECTIVE – III

Course Code	DISASTER MANAGEMENT AND MITIGATION		L	T	P	C
21A010503			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To obtain the basic knowledge of Environmental Hazards and disasters.
- To understand the basics of Endogenous and Exogenous hazards and gives a suitable picture on the different types of hazard and disaster mitigation methods.
- To understand the key concepts of disaster management related to development and the relationship of different disaster management activities.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze and evaluate the environmental, social, cultural, economic, legal and organizational Aspects influencing vulnerabilities and capacities to face disasters and to know about different types of environmental hazards. **(K4)**

CO2: Compute knowledge on different types of natural and man- made disasters. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery). **(K3)**

CO3: Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ. **(K3)**

CO4: Identify endogenous and exogenous hazards their harmful effects to the environment, Case studies of India. **(K1)**

CO5: Identify the regulatory controls used in hazard management. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO2	3	3	3	3	-	-	2	1	-	-	2	-	2	-
CO3	3	3	3	3	-	-	2	2	-	-	2	-	2	-
CO4	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO5	3	3	2	3	-	-	2	1	-	-	2	-	3	-

UNIT – I (8 Hrs)

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Learning Outcomes: At the end of this unit, students should be able to

- Debate on the Knowledge of the disaster phenomenon, its different contextual aspects, impacts and public health consequences. (L5)
- Express about the natural hazards and its management. (L6)

UNIT – II (10 Hrs)

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

Learning Outcomes: At the end of this unit, students should be able to

- Explain the Capacity to manage the Public Health aspects of the disasters. (L4)
- Distinguish the different types of environmental hazards & disasters. (L5)

UNIT – III (9 Hrs)

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the regulations of building codes and land use planning related to risk and vulnerability. (L4)
- Justify the financial management of disaster and related losses. (L6)

UNIT – IV (9 Hrs)

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Mitigation and control measures of exogenous hazards. (L2)
- Analyze, and communicate information on risks, relief needs and order to formulate strategies for mitigation. (L4)

UNIT – V (9 Hrs)

Soil Erosion: - Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion. Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global

Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation. Biological hazards/ disasters:- Population Explosion.

Learning Outcomes: At the end of this unit, students should be able to

- Relate their interconnections, particularly in the field of the Public Health aspects of the disasters. (L3)
- Understand different approaches to prevent disasters. (L2)

<u>TEXTBOOKS:</u>

1. "Disaster Management", Rajib Shah, Universities Press, India, 2003
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Disaster Mitigation: Experiences and Reflections", Pardeep Sahni
4. "Natural Hazards & Disasters", Donald Hyndman & David Hyndman, Cengage Learning.

<u>REFERENCE BOOKS:</u>

1. "The Environment as Hazards", Kates, B.I & White, G.F, Oxford Publishers, New York, 1978
2. "Disaster Management", R.B. Singh (Ed), Rawat Publication, New Delhi, 2000
3. "Disaster Management", H.K. Gupta (Ed), Universities Press, India, 2003
4. "Space Technology for Disaster Mitigation in India (INCED)", R.B. Singh, University of Tokyo, 1994.

<u>ONLINE LEARNING RESOURCES:</u>

1. http://ndma.gov.in
2. http://www.ndrf.gov.in

Course Code	OPTIMIZATION TECHNIQUES		L	T	P	C
21A030505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the basic fundamentals of optimization methods that can be used during a design process.
- To expose the students to different modern optimization techniques.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand basic theoretical principles of optimization models and its solution. **(K2)**
CO2: Formulate the given practical problem and solving by graphical /simplex method. **(K3)**
CO3: Analyse the cost for transportation and assigning the jobs to machines. **(K3)**
CO4: Analyse the cost and duration of the project, also preparation of job scheduling. **(K3)**
CO5: Use latest methods for optimization. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	1	2	2	1	-	-
CO2	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO3	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO4	3	3	3	3	-	2	-	1	1	-	2	1	-	-
CO5	3	3	3	3	2	2	-	-	2	-	2	1	-	-

UNIT – I (10 Hrs)

Introduction to Optimization: Classification of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems.

Classical Optimization Techniques: Single variable optimization, Multi-variable: Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions

Learning Outcomes: At the end of this unit, students should be able to

- Explain how to formulate statement of optimization problem with or without constraints. (L3)
- Explain about classification of single and multivariable optimization problems. (L3)
- Know about necessary and sufficient conditions in defining the optimization problems. (L1)
- Understand how to formulate Kuhn-Tucker conditions and to solve numerical problems. (L3)

UNIT – II (8 Hrs)
Linear Programming: Statement of an LP problem, Graphical Solution of an LP problem, Simplex method, Two phase method, Dual simplex method.
Learning Outcomes: At the end of this unit, students should be able to

- Formulation of problem as LPP. (L4)
- Solve numerical problems with graphical method, Simplex method, two phase method and dual simplex method. (L4)

UNIT – III (9 Hrs)
Transportation Problems: Introduction, Optimal Solution for BFS, Unbalanced Transportation Problem, Transshipment, Assignment Problems, Hungarian Method.
***Learning Outcomes*:** At the end of this unit, students should be able to

- Model linear programming problems like the transportation. (L6)
- Solve the problems of transportation from origins to destinations with minimum time and cost. (L3)
- Solve assignment problems. (L4)

UNIT – IV (10 Hrs)
Project Management: Introduction, Critical Path Method, Critical Path Determination, Optimal Scheduling by CPM, Project Evaluation and Review Technique.
Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.
Learning Outcomes: At the end of this unit, students should be able to

- Represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project. (L4)
- Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability. (L4)
- Solve problems of production scheduling. (L3)

UNIT – V (8 Hrs)
Modern Methods of Optimization: An overview of evolutionary algorithms, Genetic algorithms, simulated annealing, fuzzy optimization, neural-network based methods, Particle swarm optimization.
***Learning Outcomes*:** At the end of this unit, students should be able to

- Solve the numerical problems using modern optimization techniques. (L4)

TEXTBOOKS:

1. "Engineering Optimization- Methods and Applications", A. Ravindran, K. M. Ragsdell, G.V. Reklaitis, Wiley India Edition, 2nd Edition.
2. "Operations Research: An Introduction", H.A. Taha, PHI Pvt. Ltd., 6th Edition

REFERENCE BOOKS:

1. "Introduction to Optimum Design", J S Arora, Mc-Graw Hill.
2. "Optimization Methods for Engineering Design", Fox, R. L., Addison Wesley, 2001.
3. "Multi-objective optimization using evolutionary algorithms", K Deb John Wiley Publications.
4. "Operations Research", Dr. J. K. Sharma, Mc Millan.
5. "Engineering Optimization: Theory and Practice", Singiresu S. Rao, John Wiley & Sons

Course Code	GLOBAL WARMING AND CLIMATE CHANGES		L	T	P	C
21A030506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To know the basics, importance of global warming.
- To know the concepts of mitigation measures against global warming
- To know the impacts of climate changes

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know the impact of Ozone layer on green house effect and global warming. **(K1)**
CO2: Understand the structure of atmosphere and effects of inversion on pollution dispersion. **(K2)**
CO3: Know the effect of global warming and climatic changes on environment. **(K1)**
CO4: Understand Global change in temperature and climate and measures to reduce the effect. **(K2)**
CO5: Understand the clean technology, use of renewable energy, mitigation technologies and their practices **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO5	1	2	-	2	-	-	-	-	2	-	-	2	-	-

UNIT – I (7 Hrs)

EARTH'S CLIMATE SYSTEM:

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Green house gases and green house effect, Hydrological cycle and Carbon cycle, Global warming and its impacts

Learning Outcomes: At the end of this unit, students should be able to

- Identity the importance of Ozone and effect of green house gases. (L1)
- Know the effect of global warming. (L1)

UNIT – II (9 Hrs)

ATMOSPHERE & ITS COMPONENTS: Atmosphere and its layers-Characteristics of Atmosphere - Structure of Atmosphere - Composition of Atmosphere - Atmospheric stability -

Temperature profile of the atmosphere - Temperature inversion and effects of inversion on pollution dispersion.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the layers of atmosphere and their characteristics. (L1)

UNIT – III (8 Hrs)

IMPACTS OF CLIMATE CHANGE: Causes of Climate change - Change of Temperature in the environment - Melting of ice and sea level rise - Impacts of Climate Change on various sectors - Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and its effects on various sectors. (L1)

UNIT – IV (10 Hrs)

OBSERVED CHANGES AND ITS CAUSES: Climate change and Carbon credits-Clean Development Mechanism (CDM), CDM in India - Kyoto Protocol - Intergovernmental Panel on Climate Change (IPCC) - Climate Sensitivity - Montreal Protocol - United Nations Framework Convention on Climate Change (UNFCCC) - Global change in temperature and climate and changes within India

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and carbon credits, effect of change in temperature and climate on India. (L1)

UNIT – V (11 Hrs)

CLIMATE CHANGE AND MITIGATION MEASURES: CDM and Carbon Trading - Clean Technology, biodiesel, compost, biodegradable plastics - Renewable energy usage as an alternative - Mitigation Technologies and Practices within India and around the world - Non-renewable energy supply to all sectors - Carbon sequestration - International and regional cooperation for waste disposal biomedical wastes, hazardous wastes, e-wastes, industrial wastes, etc.,

Learning Outcomes: At the end of this unit, students should be able to

- Know about the clean technology, use of renewable energy, mitigation technologies and their practices. (L1)

TEXTBOOKS:

1. “Climate Change – An Indian Perspective”, Dash Sushil Kumar, Cambridge University Press India Private limited 2007.

REFERENCE BOOKS:

1. "Adaptation and mitigation of climate change-Scientific Technical Analysis", Cambridge University Press, Cambridge, 2006.
2. "Atmospheric Science", J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3. "Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Jan C. van Dam, Cambridge university press, 2003.
4. "Global Warming: Understanding the Forecast"", David Archer, Wiley, 2nd Edition, 2011
5. "Global Warming: The Complete Briefing", John Houghton, Cambridge University Press, 5th Edition, 2015

Course Code	ELECTRONIC SENSORS		L	T	P	C
21A040505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To learn the characterization of sensors.
- To know the working of Electromechanical, Thermal, Magnetic and radiation sensors
- To understand the concepts of Electro analytic and smart sensors
- To be able to use sensors in different applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the Principles of different sensors, Characterization and working of Electro mechanical Sensors. **(K3)**

CO2: Analyze the working of Thermal sensors. **(K4)**

CO3: Compare the working of magnetic resistor and hall effect sensors. **(K4)**

CO4: Explain the working of radiation and Electro analytic Sensors. **(K3)**

CO5: Develop a system with smart sensors. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (9 Hrs)

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of sensors/Transducers principles. (L2)
- Understand the concepts of Electro mechanical sensors. (L2)
- Identify the operation of Inductive and capacitive sensors. (L3)

UNIT – II (9 Hrs)

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Thermal sensors. (L2)
- Understand the working of Thermal radiation sensors. (L2)
- Identify the types of semiconductor sensors. (L3)
- Analyse the operation of heat flux sensors. (L4)

UNIT – III (9 Hrs)

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principles of Magnetic sensors. (L2)
- Summarize the concepts of Angular transducers. (L2)
- Compare the working of magnetic resistor and Hall effect sensors. (L4)

UNIT – IV (9 Hrs)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors, Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of radiation sensors. (L2)
- Summarize the types of photo detectors. (L2)
- Explain different electrodes and sensors. (L3)

UNIT – V (9 Hrs)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications, Introduction- On-board Automobile

Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of smart sensors. (L2)
- Summarize the applications of automation sensor. (L2)
- Develop different sensors used in the industries and manufacturing. (L3)

TEXTBOOKS:

1. "Sensors and Transducers", D. Patranabis, PHI Learning Private Limited., 2003.
2. "Introduction to sensors", John veteline, Aravind Raghu, CRC press, 2011

REFERENCE BOOKS:

1. "Sensors and Actuators", D. Patranabis, PHI, 2nd Edition, 2013.
2. "Make sensors", Tero Karvinen, Kimmo Karvinen and Ville Valtokari, Maker media, 1st Edition, 2014.
3. "Sensors handbook", Sabrie Soloman, TMH, 2nd Edition, 2009

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108147
2. http://www.nitttrc.edu.in/nptel/courses/video/101104066/101104066.html

Course Code	INTRODUCTION TO IMAGE PROCESSING		L	T	P	C
21A040506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce fundamentals of Image Processing.
- To expose various intensity transformations in spatial and frequency domains.
- To impart concepts of wavelets and various coding techniques for image compression.
- To dissimilate various segmentation techniques for images.
- To teach various color models and to introduce the concepts of color image segmentation.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various types of images mathematically. **(K4)**
CO2: Compare image enhancement methods in spatial and frequency domains. **(K3)**
CO3: Apply various segmentation algorithms for processing an image. **(K3)**
CO4: Categorize various compression techniques and color models. **(K4)**
CO5: Apply various techniques for color image smoothing, sharpening and segmentation. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO4	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels: neighbourhood, adjacency, connectivity, distance measures. Mathematical tools/ operations applied on images.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic building blocks of image processing. (L2)
- Define image processing parameters such as adjacency and distance measures. (L1)
- Analyze various types of images mathematically. (L4)

UNIT – II (9 Hrs)

Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain

sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Learning Outcomes: At the end of this unit, students should be able to

- Apply spatial domain and frequency Domain filtering techniques for image enhancement (L3)
- Compare image enhancement methods in spatial and frequency domains. (L3)

UNIT – III (9 Hrs)

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various Image segmentation techniques. (L2)
- Illustrate detection of discontinuities in an image. (L2)
- Apply various segmentation algorithms for processing an image. (L3)

UNIT – IV (9 Hrs)

Image Compression: Redundancy, inter-pixel and psycho-visual; Loss less compression-predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various transform techniques for lossy compression. (L2)
- Apply various coding techniques for lossless compression. (L3)

UNIT – V (9 Hrs)

Color Image Processing: Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various color models for color image processing. (L2)
- Apply various techniques for color image smoothing, sharpening and segmentation. (L3)

TEXTBOOKS:

1. "Digital Image Processing", R.C. Gonzalez and R.E. Woods, Pearson Education, 2nd Edition, 2008.
2. "Fundamentals of Digital Image Processing", Anil Kumar Jain, Prentice Hall of India, 2nd Edition 2004.

REFERENCE BOOKS:

1. "Digital Image processing using MATLAB", Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Tata McGraw Hill, 2010.
2. "Image Processing, Analysis, and Machine Vision", Milan Sonka, Vaclav Hlavac, Roger Boule, Cengage Learning, 3rd Edition, 2016.
3. "Digital Image processing", S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.
4. "Digital Image Processing", William K. Pratt, John Wiley, 3rd Edition, 2004.

ONLINE LEARNING RESOURCES:

1. https://www.udemy.com/course/learn-image-analysis/
2. https://alison.com/tag/image-processing
3. https://nptel.ac.in/courses/117/105/117105135/

Course Code	INRODUCTION TO INTERNET OF THINGS		L	T	P	C
21A050505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

COURSE OUTCOMES:

At the end of the unit, students will be able to:

CO1: Analyze various protocols for IoT. **(K4)**
CO2: Design a PoC of an IoT system using Raspberry Pi/Arduino. **(K3)**
CO3: Apply data analytics and use cloud offerings related to IoT. **(K3)**
CO4: Analyze applications of IoT in real time scenario. **(K4)**
CO5: Analyze applications of IoT in real time Applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	-	2	1	1	2	3	-
CO2	3	2	1	2	1	1	-	-	2	-	1	2	3	-
CO3	3	3	2	2	1	-	-	-	2	-	2	2	3	-
CO4	3	3	2	2	1	-	-	-	2	-	2	2	3	-
CO5	3	3	2	2	1	-	-	-	2	-	2	2	3	-

UNIT – I (10 Hrs)

FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain IoT architecture. (L2)
- Interpret the design principles that govern connected devices. (L2)
- Summarize the roles of various organizations for IoT. (L2)
- Interpret the significance of Prototyping. (L2)

UNIT – II (10 Hrs)

IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP

versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basics of microcontrollers. (L2)
- Outline the architecture of Arduino. (L2)
- Develop simple applications using Arduino. (L3)
- Outline the architecture of Raspberry Pi. (L2)
- Develop simple applications using Raspberry Pi. (L3)
- Select a platform for a particular embedded computing application. (L3)

UNIT – III (8 Hrs)

DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

Learning Outcomes: At the end of this unit, students should be able to

- Interpret different protocols and compare them. (L2)
- Select which protocol can be used for a specific application. (L3)
- Utilize the Internet communication protocols for IoT applications. (L3)
- Select IoT APIs for an application. (L3)
- Design and develop a solution for a given application using APIs. (L6)
- Test for errors in the application. (L4)

UNIT – IV (8 Hrs)

DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

Learning Outcomes: At the end of this unit, students should be able to

- Plan the business model. (L6)
- Predict the market value. (L6)
- Build the product. (L6)

UNIT – V (9 Hrs)

CASE STUDIES/INDUSTRIAL APPLICATIONS: Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility

Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the manufacturing techniques. (L2)
- Adapt the Ethics of the IoT. (L6)

TEXTBOOKS:

1. "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

REFERENCE BOOKS:

1. "Database System Concepts", Silberschatz, Korth, TMH, 5th Edition
2. "Introduction to Database Systems", C J Date, PEA, 8th Edition
3. "The Database book principles & practice using Oracle/MySql", Narain Gehani, University Press.

ONLINE LEARNING RESOURCES:

1. https://en.wikipedia.org/wiki/Cloud_computing
2. https://www.infoworld.com/article/2683784/what-is-cloud-computing.html

Course Code	WEB TECHNOLOGIES FOR BEGINNERS		L	T	P	C
21A050506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- This course is designed to introduce students with no programming experience to the programming languages
- Techniques associated with the World Wide Web.
- The course will introduce web-based media-rich programming tools for creating interactive web pages.

COURSE OUTCOMES:

After completing the course student will be able to

CO1: Analyze a web page and identify its elements and attributes. **(K4)**
CO2: Create web pages using XHTML and Cascading Styles sheets. **(K5)**
CO3: Build dynamic web pages. **(K5)**
CO4: Build web applications using PHP. **(K5)**
CO5: Programming through PERL and Ruby, client-side scripts using AJAX **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	3	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	3	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	3	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	3	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	3	-

UNIT – I (9 Hrs)

HTML tags, Lists, Tables, Images, forms, Frames. Cascading style sheets. Introduction to Java script. Objects in Java Script. Dynamic HTML with Java Script

Learning Outcomes: At the end of this unit, students should be able to

- Create standard tags of HTML tags and Knowing the features of designing static web pages. (L6)
- List different types of CSS to design webpage attractively. (L1)
- Apply Java script concepts and create dynamic HTML pages. (L4)

UNIT – II (10 Hrs)

Working with XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how XML interacts with different applications. (L1)
- Examine background applications using XSL and XSLT. (L4)

<u>UNIT – III</u> (9 Hrs)

AJAX A New Approach: Introduction to AJAX, Integrating PHP and AJAX. Consuming WEB services in AJAX: (SOAP, WSDL, UDDI)

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of AJAX Architecture. (L2)
- Integrate and test web services. (L5)

<u>UNIT – IV</u> (9 Hrs)

PHP Programming: Introducing PHP: Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements, Arrays, functions. Working with forms and Database such as my Sql.

Learning Outcomes: At the end of this unit, students should be able to

- Develop PHP Programs using WAMP and XAMPP Server. (L3)
- Create a website with a Database (My SQL) in PHP. (L5)

<u>UNIT – V</u> (8 Hrs)

Introduction to PERL, Perl language elements, Interface with CGI- A form to mail program, Simple page search

Learning Outcomes: At the end of this unit, students should be able to

- Creating simple programs with PERL. (L4)
- Comparing CGI with other server-side technologies. (L5)

<u>TEXTBOOKS:</u>

1. "Programming the World Wide Web", Robert W Sebesta, Pearson Education, 7th Edition
2. "Web Technologies", Uttam K Roy, Oxford University Press
3. "The Web Warrior Guide to Web Programming", Bai, Ekedahl, Farrelll, Gosselin, Zak, Karparhi, Maclntyre, Morrissey, Cengage Learning

<u>REFERENCE BOOKS:</u>

1. "Ruby on Rails Up and Running, Lightning fast Web development", Bruce Tate, Curt Hibbs, Oreilly Media Inc., 2006
2. "Programming Perl", Tom Christiansen, Jonathan Orwant, Oreilly Media Inc., 4th Edition, 2012

3. “Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX”, Black book, Dream Tech.
4. “An Introduction to Web Design, Programming”, Paul S Wang, Sanda S Katila, Cengage Learning.

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/html/
2. https://www.w3schools.com/js/
3. https://www.w3schools.com/xml/xml_whatis.asp
4. https://www.w3schools.com/php/

OPEN ELECTIVE – IV

Course Code	COST EFFECTIVE HOUSING TECHNIQUES		L	T	P	C
21A010504			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To train the students to have a comprehensive knowledge of planning, design, evaluation, construction
- To train the students to financing of housing projects
- To Provide Knowledge on cost effective construction materials and methods.
- To teach the principles of sustainable housing policies and programmes.

COURSE OUTCOMES:

At the end of the course, student will be able to

CO1: Understand about planning, design, evaluation, construction and financing of housing projects with cost effective housing techniques. **(K2)**

CO2: Choose the basic housing programmes and services and slum improvement and relocation. **(K3)**

CO3: The student can be in a position to adopt the suitable techniques in construction of low cost constructions. **(K6)**

CO4: Understand about alternate building materials for low cost housing techniques and sanitation services in rural areas. **(K2)**

CO5: The student can be in a position to analyze the suitable techniques in rural and disaster prone areas by using locally available materials. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

INTRODUCTION TO HOUSING: Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the about basics about housing norms. (L4)

- Understand the objectives and strategies of housing policies. (L2)

UNIT – II (9 Hrs)

HOUSING PROGRAMMES: Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate the usage of GIS and MIS in housing projects. (L4)
- Explain about development of plots and gated communities. (L4)

UNIT – III (9 Hrs)

DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY: Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements - Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall - Fly ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

Learning Outcomes: At the end of this unit, students should be able to

- Write about the adoption of Economical Wall System. (L6)
- Write about Adoption of precast R.C. plank and join system for roof/floor in the building. (L6)

UNIT – IV (9 Hrs)

ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING AND INFRASTRUCTURE SERVICES IN RURAL HOUSES: Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Low cost Infrastructure services: Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy. Rural Housing**:** Introduction traditional practice of rural housing continuous - Mud Housing technology-Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs.

Learning Outcomes: At the end of this unit, students should be able to

- Determine about alternate building materials for low cost housing construction. (L3)
- Justify about low cost sanitation from traditional methods. (L6)

UNIT – V (9 Hrs)

HOUSING IN DISASTER PRONE AREAS: Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirements of structural safety of thin pre-cost roofing units against Earthquake forces -Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about Type of Damages and Railways of non-engineered buildings. (L4)
- Express about Repair and restore action of earthquake Damaged structures and for future constructions. (L6)

TEXTBOOKS:

1. "Hand book of Low Cost Housing", A. K. Lal, New Age International publishers.
2. "Low Cost Housing", G.C. Mathur, IBH Publishers.
3. "Housing in India", Francis Cherunilam and Odeyar D Heggade, Himalaya Publishing House, Bombay, 1997.

REFERENCE BOOKS:

1. "Disaster Management", Rajib Shaw, Universities Press, India.
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Building Materials For Low–Income Houses", International Council For Building Research Studies And Documentation.
4. "Modern Trends In Housing In Developing Countries", A.G. Madhava Rao, D.S. Rama Chandra Murthy & G. Annamalai.
5. "Properties of Concrete"', Neville A.M. Pitman Publishing Limited, London.
6. "Light Weight Concrete", Academic Kiado, Rudhai.G, Publishing home of Hungarian Academy of Sciences, 1963.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/124107001
2. https://nptel.ac.in/courses/105103206
3. https://onlinecourses.nptel.ac.in/noc20_ar14/preview4

Course Code	BASICS OF AUTOMOTIVE ENGINEERING		L	T	P	C
21A030507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce various components of an automobile and engine sub systems.
- To impart knowledge on various safety systems of an automobile and emission norms.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the various components of an automobile and Working of fuel supply system. **(K2)**
CO2: Know the working of various lubrication and cooling systems. **(K1)**
CO3: Familiarize with the various systems such as ignition system and transmission system. **(K2)**
CO4: Explain the suspension, braking systems of an automobile and their differences. **(K2)**
CO5: Know about the emissions from engine and safety norms for the operation of an automobile. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction: classification of automobiles, Components of four wheeler automobile- chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive

Fuel supply systems: simple fuel supply system in petrol and diesel engines. Working of simple Carburetor, direct fuel injection system in diesel engine.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the parts of automobile engines. (L2)
- Understand the concept of fuel supply systems. (L2)

UNIT – II (7 Hrs)

Lubricating System: Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.

Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the function of Lubricating system. (L3)

UNIT – III (10 Hrs)

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, Electronic ignition system.

Transmission system: Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, Types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the concept of Ignition system and its types. (L2)
- Understand the concept of Transmission system. (L2)

UNIT – IV (10 Hrs)

Suspension System: Objectives of suspension system, front suspension system rigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the working of suspension system and its types. (L2)
- Analyze the different types of braking systems. (L3)

UNIT – V (9 Hrs)

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. Engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand emission concept in automobiles engines. (L2)
- Understand the concept of safety system. (L2)

TEXTBOOKS:

1. "Automobile Engineering Vol-1 & vol-2", Kirpal Singh, Standard Publishers Distributors, 11th Edition.
2. "Automotive Mechanics", William H Crouse & Donald LAnglin, Tata Mc Graw Hill Publications, 10th Edition.
3. "Automobile Engineering", Rajput, Laxmi Publications.

REFERENCE BOOKS:

1. "Automobile Engineering", R.B Gupta, Satya Prakashan Publications, 6th Edition.
2. "The Motor vehicle", Newton steeds & Garrett, Society of Automotive Engineers, 13th Edition.
3. "Automotive Engineering", G.B.S. Narang, Khanna Publishers, 5th Edition.
4. "Automotive Mechanics", Joseph Heitner, IPC Transport Press Ltd, 2nd Edition.
5. "The Automobile", Harbans Singh Reyat, S. Chand & company Pvt. Ltd., 6th Edition.

Course Code	BASICS OF TOTAL QUALITY MANAGEMENT		L	T	P	C
21A030508			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concept of quality, cost of quality, international quality standards.
- To learn the principles of Total quality management, techniques for problem solving.
- To learn about various tools of quality management used in various industrial applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts of Quality and Quality Control Techniques. **(K2)**
CO2: Understand TQM concepts and History and able to use quality tools for problem solving. **(K2)**
CO3: Use TQM techniques and to formulate quality circles to find solutions with team work. **(K2)**
CO4: Apply various TQM Methods to solve problems in industry. **(K3)**
CO5: Analyze various quality problems and contribute towards continuous improvement in the system. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	2	-	2	2	2	-	2	-	-	-	2	-	-
CO5	1	-	-	-	-	2	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Inspection & Quality Control

Statistical Quality Control (SQC) – Techniques - variables and attributes Control charts : $\bar{X}$ - R Charts, P-Chart, C-Chart. Acceptance Sampling – Single and Double sampling Plan - OC Curves. BIS and ISO Standards – Importance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Control charts: $\bar{X}$ - R Charts, P-Chart, C-Chart, single and double sampling plans and BIS&ISO standards. (L1)

UNIT – II (8 Hrs)

TQM – concepts, History-Quality management philosophies-Juran, Deming, Crosby, Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – internal and external customers - TQM tools & techniques- 7 QC tools- 7 New QC tools.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various quality management philosophies, Evaluation of TQM, TQM tools and technologies. (L1)

UNIT – III (10 Hrs)

Problem solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis, Quality circles – organization – team approach.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse Problem solving process, system failure analysis, fault tree analysis, pedigree analysis and concept Quality circles. (L4)

UNIT – IV (10 Hrs)

Quality Function Development (QFD) – elements of QFD –benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Know the procedure for quality function development, bench marking, taguchi analysis. (L1)

UNIT – V (8 Hrs)

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management, Six sigma approach – application of six sigma approach to various industrial situations.

Learning Outcomes: At the end of this unit, students should be able to

- Know the value improvement, supplier teaming and the concept of business process re-engineering, supply chain management and six sigma. (L1)

TEXTBOOKS:

1. “Total Quality Management”, D.R.Kiran, BS Publications, 2016
2. “Total Quality Management”, Bester field, Pearson.

REFERENCE BOOKS:

1. “Quality management”, Howard Giltow, TMH
2. “Quality management”, Evans.
3. “Quality management”, Bedi
4. “Total Quality Management”, Joseph & Susan Berg
5. “Total Quality Management-Toward the Emerging Paradigm”, Bounds, Yorks, Adams, Ranney, McGraHill, 1994

Course Code	PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS		L	T	P	C
21A040507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyze cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts and operation of cellular systems. **(K2)**

CO2: Apply the concepts of co-channel interference & Cell splitting to solve engineering problems. **(K3)**

CO3: Compare different Handoffs. **(K4)**

CO4: Compare various types of multiple access techniques. **(K4)**

CO5: Evaluate suitability of a cellular system in real time applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	3

UNIT – I (10 Hrs)

Introduction to Cellular Mobile Systems: Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts and operation of cellular systems. (L2)
- Explain the characteristics of mobile radio environment. (L2)

UNIT – II (8 Hrs)

Cellular Radio System Design: General description of the problem, Concept of frequency reuse channels, Co-channel interference reduction, Desired C/I ratio, Cell splitting and sectoring, Microcell zone concept.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of frequency reuse and co-channel interference in cellular systems. (L2)
- Apply the concept of cellular systems to solve engineering problems. (L3)
- Explain the design problems of cellular systems. (L3)

UNIT – III (10 Hrs)

Handoffs and Dropped Calls: Why handoffs and types of handoffs, Initiation of handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Inter system handoff. Introduction to dropped call rate.

Learning Outcomes: At the end of this unit, students should be able to

- Understand why handoff is required. (L2)
- Apply handoff techniques to solve engineering problems. (L3)
- Compare various types of handoffs. (L4)

UNIT – IV (8 Hrs)

Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various types of multiple access techniques. (L2)
- Apply the concept of multiple access to solve engineering problems. (L3)
- Compare various types of multiple access techniques. (L4)

UNIT – V (9 Hrs)

Digital Cellular Systems: Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

Learning Outcomes: At the end of this unit, students should be able to

- Understand operation of various types of digital cellular systems. (L2)
- Compare various types of digital cellular systems. (L2)
- Evaluate suitability of a cellular system in real time applications. (L4)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Mobile Cellular Tele communications", William C.Y.Lee, McGraw – Hill International, 2 nd Edition, 1995.
2. "Wireless Communications–Principles and Practice", Theodore S. Rappaport, PHI, 2nd Edition, 2004.

REFERENCE BOOKS:

1. "Principles of Modern Wireless Communications Systems –Theory and Practice", Aditya K. Jagannatham, McGraw – Hill International, 2015.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117102062
2. https://www.electronicshub.org/wireless-communication-introduction-types-applications/

Course Code	EMBEDDED SYSTEMS		L	T	P	C
21A040508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the basics of an embedded system
- To introduce the typical components of an embedded system
- To explain various communication interfaces used in embedded system
- To provide knowledge on the design process of embedded system applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Discuss the basic concepts of an embedded system. **(K3)**
CO2: Explainthe role of system core, memory, sensors, actuators, I/O and other sub system components in an embedded system. **(K3)**
CO3: Explain the different communication interfaces of an embedded system. **(K3)**
CO4: Illustrate about the interrupt service mechanism and device drivers. **(K3)**
CO5: Write aboutvarious steps involved in design and development of embedded firmware. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

Introduction to Embedded Systems: Definition, Embedded systems Vs General computing systems, History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

Learning Outcomes: At the end of this unit, students should be able to

- Classify embedded systems based on generation, complexity and performance. (L2)
- Discuss the characteristics of an embedded system. (L2)
- Explain the design process in embedded system. (L3)

<u>UNIT – II</u> (9 Hrs)

Typical Embedded System: Core of the embedded system, Memory-ROM, RAM, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer, PCB and passive components

Learning Outcomes: At the end of this unit, students should be able to

- Discuss about the core of the embedded system. (L2)
- Summarize different factors to be considered in the selection of memory for an embedded system. (L2)
- Explain the role of sensors, actuators, I/O components and other subsystem components used in embedded system. (L3)

<u>UNIT – III</u> (9 Hrs)

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various types of on-board communication interfaces. (L3)
- Describe the external communication interfaces used in embedded system. (L2)
- Discuss the different types of wireless communication interfaces used in embedded system. (L2)

<u>UNIT – IV</u> (9 Hrs)

Device drivers and Interrupt Service Mechanism: Programmed I/O busy-wait approach without interrupt service mechanism, Interrupt-driven I/O, interrupt service routine concept, interrupt sources, hardware interrupts, software interrupts, interrupt-servicing mechanism, multiple interrupts, interrupt service threads as second-level interrupt handlers, context and the periods for context switching, interrupt latency, interrupt-service deadline, interrupt service mechanism form context-saving angle, Device driver programming.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize pros and cons of interrupt driven data transfer. (L2)
- Illustrate hardware and software interrupts with examples. (L3)
- Know how interrupts can be used to minimize latency. (L3)
- Describe uses of hardware and software assigned priorities in an interrupt service mechanism. (L2)
- Differentiate ISRs & device driver functions. (L2)

<u>UNIT – V</u> (8 Hrs)

Embedded Firmware Design and Development: Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the different approaches for embedded firmware design. (L2)
- Discuss the different embedded firmware development languages. (L2)
- Explain the process of Assembly language to machine language conversion and High-level language to machine language conversion. (L3)
- Write about various steps involved in design and development of embedded firmware. (L3)

<u>TEXTBOOKS:</u>

1. "Introduction to Embedded Systems", Shibu. K.V., McGraw Hill Education, 2nd Edition, 2017.
2. "Embedded Systems: Architecture, Programming and Design", Raj Kamal, McGraw Hill Education, 3rd Edition, 2017

<u>REFERENCE BOOKS:</u>

1. "Computers as Components", Wayne Wolf, Morgan Kaufmann, Elsevier, 2nd Edition
2. "Embedded Systems- An integrated approach", Lyla B Das, Pearson education, 2012
3. "Embedded Microcomputer Systems Real Time Interfacing", Jonathan W.Valvano, Cengage Learning, 3rd Edition, 2012.

Course Code	CLOUD COMPUTING – AWS		L	T	P	C
21A050507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Define cloud services and models
- Demonstrate design the architecture for new cloud application.
- Explain how to re-architect the existing application for the cloud

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the procedure for Cloud deployment. **(K3)**
CO2: Distinguish different cloud service models and deployment models. **(K3)**
CO3: Compare different cloud services. **(K4)**
CO4: Implementation of various services in cloud environment. **(K5)**
CO5: Design applications for an organization which use cloud environment. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	2	1	-	-	1	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-	2	2
CO4	3	-	2	-	-	-	-	-	3	-	-	-	-	2
CO5	3	-	2	-	-	-	-	-	3	-	-	-	-	2

UNIT – I (9 Hrs)

Introduction to Cloud Computing: Introduction to Cloud Computing, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the Cloud characteristics and models. (L2)
- Classify different models, different technologies in cloud. (L2)

UNIT – II (9 Hrs)

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and

Management Services, Identity and Access Management Services, Open Source Private Cloud Software, Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the Services and Platform of cloud. (L2)
- Demonstrate Hadoop Cluster Setup. (L2)

UNIT – III (9 Hrs)

Cloud Application Design: Design Considerations, Reference Architectures, Cloud Application Design Methodologies, Data Storage Approaches, Multimedia Cloud: Introduction, Case Study: Live Video Streaming App, Streaming Protocols, Case Study: Video Transcoding APP.

Learning Outcomes: At the end of this unit, students should be able to

- Design and build cloud applications. (L6)
- Describe the multimedia cloud. (L2)

UNIT – IV (10 Hrs)

Python for Amazon Web Services: Python for Amazon Web Services, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.

Learning Outcomes: At the end of this unit, students should be able to

- Select different cloud services from different vendors. (L2)
- Utilize Python language to access cloud services. (L3)

UNIT – V (8 Hrs)

Case Study: Various Web Applications - Cloud Application Development in Python, Design Approaches, Image Processing APP, Document Storage App, Social Media Analytics App, Cloud Application Benchmarking and Tuning, Cloud Security, Cloud Computing for Education.

Learning Outcomes: At the end of this unit, students should be able to

- Investigate different Cloud applications. (L4)
- Design cloud applications using Python. (L6)

TEXTBOOKS:

1. “Cloud Computing: A Hands-on Approach”, Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

REFERENCE BOOKS:

1. “Azure in Action”, Chris Hay, Brian Prince, Manning Publications [ISBN: 9781935182481], 2010.
2. “Introducing Windows Azure” Henry Li, Apress, 1st Edition [ISBN: 978-14302-2469- 3], 2009.

Course Code	BASICS OF CRYPTOGRAPHY & NETWORK SECURITY		L	T	P	C
21A050508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand essential building blocks and basic concepts of cyber security
- Explore Web security and Network security
- Explain the measures for securing the networks and cloud
- Understand privacy principles and policies
- Describe the legal issues and ethics in computer security

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection. **(K3)**

CO2: Assess the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure. **(K4)**

CO3: Identify the nature of secure software development and operating systems. **(K3)**

CO4: Demonstrate the role security management in cyber security defense. **(K2)**

CO5: Adapt the legal and social issues at play in developing solutions. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	2
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Vulnerabilities, threats and. Counter measures for computer security. (L2)
- Interpret the design of the malicious code. (L2)

UNIT – II (9 Hrs)

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Root kit.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the attacks on browser, Web and email. (L2)
- Explain the security aspects of Operating Systems. (L3)

UNIT – III (9 Hrs)

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management.

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network security threats and attacks. (L3)
- Design the Counter measures to defend the network security attacks. (L4)
- Analyze the security tools and techniques for Cloud computing. (L4)

UNIT – IV (9 Hrs)

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster

Learning Outcomes: At the end of this unit, students should be able to

- Interpret the need for Privacy and its impacts of Emerging Technologies. (L2)
- Explain how to handle incidents and deal with Disaster. (L2)

UNIT – V (8 Hrs)

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

Learning Outcomes: At the end of this unit, students should be able to

- Adapt legal issues and ethics in computer security. (L4)
- Elaborate on the Emerging topics. (L4)

TEXTBOOKS:

1. "Security in Computing", Charles P. Fleeger, Prentice Hall, 5th Edition, 2010.
2. "Applied Cryptography", Bruce Schneier, John Wiley & Sons, 2nd Edition,1996

REFERENCE BOOKS:

1. "Information Security: The Complete Reference", Mark Rhodes-Ousley, 2nd Edition,
2. "Information Security Management: Concepts and Practice", McGraw-Hill, 2013.
3. "Roadmap to Information Security for IT and Infosec Managers", Michael E. Whitman and Herbert J. Mattord, Boston, MA: Course Technology, 2011

ONLINE LEARNING RESOURCES:

1. https://www.geeksforgeeks.org/cryptography-and-network-security-principles
2. https://onlinecourses.nptel.ac.in/noc22_cs90/preview

HONOURS

Course Code	ADVANCED POWER SEMICONDUCTOR DEVICES		L	T	P	C
21A02HN01			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand the static and dynamic characteristics of current controlled power semiconductor devices.
- To understand the static and dynamic characteristics of voltage-controlled power semiconductor devices.
- To enable the students for the selection of devices for different power electronics applications.
- To understand the control and firing circuit for different devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Choose appropriate power electronic device for a particular converter topology. **(K3)**
CO2: Analyze the principle of various current controlled power electronics devices. **(K4)**
CO3: Analyze the principle of various voltage controlled power electronics devices. **(K4)**
CO4: Describe the firing and protection of the power semiconductor devices. **(K3)**
CO5: Analyze the thermal protection of power semiconductor devices. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Introduction: Power switching devices, overview – Attributes of an ideal switch, application requirements, Device selection strategy – On-state and switching losses –Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the various power electronic switches and its characteristics (L2)
- Analyze the operating characteristics of power semiconductor switches (L4)

UNIT – II (12 Hrs)

Current Controlled Devices: BJT's – Construction, static characteristics, switching characteristics; Negative temperature co-efficient and secondary breakdown; Power darlington – Thyristors – Physical and electrical principle underlying operating mode, Two transistor analogy

– concept of latching; Gate and switching characteristics; converter grade and inverter grade and other types; series and parallel operation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the current controlled power electronic devices along with its characteristics (L2)
- Analyze the various transistor analogy and its characteristics (L4)

UNIT – III (12 Hrs)

Voltage Controlled Devices: Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady-state and dynamic models of MOSFET and IGBTs - Basics of GTO, MCT (Mos Controlled Thyristor), FCT (Field Controlled Thyristor), RCT (Reverse Conducting Thyristor) .

Learning Outcomes: At the end of this unit, students should be able to

- Understand the voltage controlled power electronic devices along with its characteristics (L2)
- Analyze the various steady state and dynamic models of voltage controlled devices (L4)

UNIT – IV (10 Hrs)

Firing and Protecting Circuits: Necessity of isolation, pulse transformer, optocopler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the firing circuits for the various power semiconductor devices (L2)
- Analyze various the protection circuits for power semiconductor devices (L3)

UNIT – V (10 Hrs)

Thermal Protection: Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for hear sink selection – Thermal resistance and impedance -Electrical analogy of thermal components, heat sink types and design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the various heat transfer techniques in power semiconductor devices (L3)
- Analyze the behaviour of heat sink and types and design of heat sinks (L3)

TEXTBOOKS:

1. "Power Electronics Circuits, Devices and Applications", Rashid M. H., Prentice Hall India, Third Edition, New Delhi.
2. "Power Electronics: Devices, Drivers, Applications and Passive Components", B.W. Williams Tata McGraw Hill.

REFERENCE BOOKS:

1. "Advanced power electronics converters", Euzeli dos santos, Edison R. da silva.
2. "Fundamentals of Power Semiconductor Devices", B. Jayanth Baliga, Springer Press, 2008.

Course Code	APPLICATIONS OF POWER ELECTRONICS TO POWER SYSTEMS		L	T	P	C
21A02HN02			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To develop the understanding of uncompensated lines and their behaviour under heavy loading conditions.
- To understand the concept and importance controllable parameters of FACTS controllers.
- To emphasize the objectives of Shunt compensation, and basic operation of SVC and STATCOM.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Transmission interconnection, Power flow in transmission system, Dynamic stability, shunt series compensation and FACT Devices **(K2)**

CO2: Analyze midpoint voltage regulation, Prevention of Voltage instability, Transient stability improvement, Static VAR compensator SVC and STATCOM **(K4)**

CO3: Describe the objectives of Series Compensation, voltage stability, improvement of transient stability, power oscillation damping, Thyristor controlled series controlled capacitors, SSSC.**(K3)**

CO4: Understands UPFC, independent real and reactive power flow control, basic control system for P and Q control.**(K2)**

CO5: Apply the power quality problems, harmonics, loads creating harmonics, harmonic power flow and mitigation, passive filters, active filters, shunt, series and hybrid filters.**(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	2		-	-	-	-	-	3	2
CO2	3	2	2	2	-	2	-	-	-	-	-	-	3	2
CO3	3	2	3	2	-	2	-	-	-	-	-	-	3	2
CO4	3	2	2	2	-	2	-	-	-	-	-	-	3	2
CO5	3	3	2	2	-	2	-	-	-	-	-	-	3	2

UNIT – I (10 Hrs)

General System considerations and FACTS: Transmission Interconnections, Flow of Power in an AC System, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, principles of series and shunt compensation, Basic Types of FACTS Controllers, Benefits from FACTS, Application of FACTS.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Transmission interconnection, Power flow in transmission system, Dynamic stability (L2)
- Analyze shunt series compensation and FACT Devices (L4)

UNIT – II (12 Hrs)

Shunt Compensators: Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, improvement of Transient Stability, Power Oscillation Damping, Static VAR Compensators, SVC and STATCOM, The Regulation Slope, Transfer Function and dynamic Performance, Transient Stability, Enhancement and Power Oscillation Damping

Learning Outcomes: At the end of this unit, students should be able to

- Understands Midpoint voltage regulation, Prevention of Voltage instability, Transient stability Improvement (L2)
- Analyze the Static VAR compensator SVC and STATCOM Enhancement of Power oscillation Damping (L4)

UNIT – III (10 Hrs)

Series Compensators: Objectives of Series Compensation, concept of series capacitive compensation, voltage stability, improvement of transient stability, power oscillation damping, GTO thyristor-controlled series capacitor, Thyristor controlled series capacitor, SSSC.

Learning Outcomes: At the end of this unit, students should be able to

- Understand objectives of Series Compensation, voltage stability, improvement of transient stability, power oscillation damping (L2)
- Analyze the Thyristor controlled series controlled capacitors, SSSC. (L4)

UNIT – IV (10 Hrs)

Combined Compensators: Introduction, Unified power flow controller, basic operating principles, independent real and reactive power flow control, and control structure, basic control system for P and Q control.

Learning Outcomes: At the end of this unit, students should be able to

- Understand UPFC, Independent real and reactive power flow control (L2)
- Analyze basic control system for P and Q control (L4)

UNIT – V (10 Hrs)

Mitigation of Harmonics: Power quality problems, harmonics, harmonic creating loads, harmonic power flow, and mitigation of harmonics, filters, passive filters, active filters, shunt, series and hybrid filters.

Learning Outcomes: At the end of this unit, students should be able to

- Understands Power quality problems, harmonics, loads creating harmonics, harmonic power flow and mitigation (L2)
- Analyze the passive filters, active filters, shunt, series and hybrid filters.(L4)

TEXTBOOKS:

1. "Understanding FACTS", Narain G. Hingorani, Laszlo Gyugyi, IEEE press
2. "Electrical Power Systems Quality", Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H. Wayne Beaty, McGraw Hill,2003

REFERENCE BOOKS:

1. "Flexible A.C. Transmission System", Y. H. Song, A. T. Johns, IEE, London, 1999

Course Code	REACTIVE POWER COMPENSATION & MANAGEMENT		L	T	P	C
21A02HN03			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To identify the necessity of reactive power compensation
- To describe load compensation
- To select various types of reactive power compensation in transmission systems
- To illustrate reactive power coordination system
- To characterize distribution side and utility side reactive power management.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Distinguish the importance of load compensation in symmetrical as well as unsymmetrical loads. **(K3)**

CO2: Observe various compensation methods in transmission lines **(K2)**

CO3: Construct model for reactive power coordination and understand demand side reactive power management. **(K4)**

CO4: Distinguish Distribution & user side reactive power management **(K3)**

CO5: Understand the concept of Reactive power management in electric traction systems and arc furnaces. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	2	2	-	-	-	2	-	3	2
CO2	3	2	2	2	-	2	-	-	-	-	2	-	3	2
CO3	3	2	3	2	-	2	-	-	-	-	2	-	3	2
CO4	3	2	2	3	-	2	-	-	-	-	2	-	3	2
CO5	3	3	2	2	-	2	-	-	-	-	2	-	3	2

UNIT – I (10 Hrs)

Load Compensation - Objectives and specifications – Reactive power characteristics – Inductive and capacitive approximate biasing – Load compensator as a voltage regulator – Phase balancing and power factor correction of unsymmetrical loads - Examples.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Reactive power characteristics (L2)
- Analyze voltage regulation and how to compensate it by Load compensator (L4)
- Solve phase balancing and power factor correction (L3)

UNIT – II (10 Hrs)

Steady – state & transient state reactive power compensation in transmission system - Uncompensated line – Types of compensation – Passive shunt and series and dynamic shunt compensation – Characteristic time periods – Passive shunt compensation – Static compensation - Series capacitor compensation – Compensation using synchronous condensers –Examples.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different Shunt compensation methods (L2)
- Analyze different Series compensation methods (L4)

UNIT – III (12 Hrs)

Reactive power coordination & demand side management - Objective – Mathematical modeling – Operation planning – Transmission benefits – Basic concepts of quality of power supply – Disturbances - Steady – state variations – Effects of under Voltages – Frequency – Harmonics, radio frequency and electromagnetic interferences. Load patterns – Basic methods - load shaping – Power tariffs - KVAR based tariffs - penalties for voltage flickers and Harmonic voltage levels.

Learning Outcomes: At the end of this unit, students should be able to

- Solve and Modelling of Transmission system (L2)
- Discuss the various different Power quality Disturbances and their Effect (L3)
- Understand different shunt compensation methods (L2)
- Solve Problems on KVAR based tariffs (L3)

UNIT – IV (12 Hrs)

Distribution & user side reactive power management - System losses – Loss reduction methods – Examples – Reactive power planning – Objectives – Economics - Planning capacitor placement – Retrofitting of capacitor banks - KVAR requirements for domestic appliances – Purpose of using capacitors – Selection of capacitors – Deciding factors – Types of capacitors, characteristics and Limitations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand and Solving System loss reduction methods (L2)
- Analyze the Economics of Reactive power planning methods (L3)

UNIT – V (10 Hrs)

Reactive power management in electric traction systems and arc furnaces - Typical layout of traction systems – Reactive power control requirements – Distribution transformers - Electric arc furnaces – Furnaces transformer – Filter requirements – Remedial measures – Power factor of an arc furnace.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Reactive power management in electric traction systems (L2)

- Gain Knowledge on Different Electric Furnaces (L3)

<u>TEXTBOOKS:</u>

1. “Reactive Power Control in Electric Power Systems”, J. E. Miller, John Wiley and Sons, 1982
2. “Reactive power Management”, D. M. Tagare, Tata McGraw Hill, 2004.

Course Code	ENERGY EFFICIENT ELECTRICAL SYSTEMS		L	T	P	C
21A02HN04			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To analyze the concepts of electricity billing and electrical load management.
- To understand the types of electrical products and systems that can lose energy.
- To learn how to measure energy loss.
- To know how to select and size equipment for the application.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understands about electricity billing, load management, maximum demand control, Power factor improvement and Distribution & transformer losses **(K2)**

CO2: Analyze different types of Motors, Losses, Efficiency, factors affecting performance of Motors Rewinding, Replacement and Energy saving methods **(K4)**

CO3: Identifies different types of lights, choice of lighting, illumination requirements and energy Efficient controls **(K3)**

CO4: Analyze the energy efficient, variable speed, smooth starting drives **(K4)**

CO5: Describe the various power Electronic Control systems **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	2	-	-	-	-	-	-	3	2
CO2	3	2	2	2	-	2	-	-	-	-	-	-	3	2
CO3	3	2	3	2	-	2	-	-	-	-	-	-	3	2
CO4	3	2	2	2	-	2	-	-	-	-	-	-	3	2
CO5	3	2	2	2	-	2	-	-	-	-	-	-	3	2

UNIT – I (10 Hrs)

Electrical System: Electricity billing, Electrical load management and maximum demand control, Power factor improvement and its benefits, Selection and location of capacitors, Performance assessment of PF capacitors, Distribution and transformer losses.

Learning Outcomes: At the end of this unit, students should be able to

- Solve Problems on Electricity billing and on concept of maximum demand (L3)
- Understand optimal location of capacitors in power system for power factor correction. (L2)

UNIT – II (10 Hrs)

Electric Motors: Types, Losses in electric motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving methods in electric motors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand and solves problems on Losses, Efficiency of Motors (L2)
- Analyze rewinding and motor replacement and energy saving methods (L4)

UNIT – III (10 Hrs)

Lighting System: Light source, choice of lighting, illumination requirements, and energy conservation aspects. Energy efficient lighting controls, comparison of sodium vapor, halogen, CFL and LED lamps.

Learning Outcomes: At the end of this unit, students should be able to

- Gain Knowledge on Choice of lighting, illumination requirements and energy conversion aspects (L2)
- Compare different Lights and understands Energy efficient lighting controls. (L3)

UNIT – IV (10 Hrs)

Electric Drives: Maximum demand controllers, energy efficient drives, soft-starters with energy saver, variable speed drives, energy efficient techniques in drives.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Energy efficient drives and soft starting techniques (L2)
- Gain knowledge on Variable speed drives and energy efficient techniques (L3)

UNIT – V (10 Hrs)

Power Electronic Systems: Automatic power factor controllers, electronic ballast, occupancy sensors, energy saving in power electronic controlled systems. Calculation of energy frequency ratio in the performance of star ratings

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of automatic power factor controller, Electronic ballast and occupancy sensors (L2)
- Gain knowledge on power electronic controlled system and energy saving, Calculate Energy Frequency ratio (L3)

TEXTBOOKS:

1. "Energy Efficiency for Engineers and Technologists", Eastop T.D & Croft D.R, Logman Scientific & Technical, ISBN-0-582-03184, 1990.

REFERENCE BOOKS:

1. "Power System Engineering", D P Kothari, I J Nagrath, 2nd Edn., Tata McGraw-Hill Co 2008
2. Bureau of Energy Efficiency (BEE) : www.bee-india.nic.in
3. The Energy and Resource Institute (TERI): http://www.teriin.org/

4. "Energy Efficiency for Engineers and Technologists", TD Eastop and DR Croft, First Edition, Longman Group UK Ltd., 1990.
5. www.bee-india.nic.in (Guide on Energy Efficient room Air conditioners)

MECHANICAL ENGINEERING

(For the batches admitted from the academic year 2021-22)

Vision

- To provide society with center of learning that makes the youth dynamic professionals with social commitment.

Mission

- Sound knowledge with analytical ability and practical exposure.
- Professional competence and creativity
- Efficient capable professionals with ethical values
- Fit for the industry

Institutional Objectives

- To create a conducive and competitive environment for students through curricular and extra-curricular activities.
- Promote the culture of research among the faculty.
- To promote synergetic alliances with premier Institutions, Industry, CSIR laboratories and various Government organizations for Collaborative Research Projects.
- To promote economic and social enrichment of the society through Skill Development programmes, Entrepreneurship, and extension activities.
- To introduce demand-driven new UG&PG academic programmes.
- To ensure a high degree of quality in terms of providing infrastructure, research ambience, faculty and staff development.

Core Values

- *Thirst for Quality Education:* The stake holders of the institute particularly management, employees and students of the institution have a consistent thirst for quality improvement of the processes and services in the institution.
- *Lifelong Learning:* In the fast-changing technological world, acquiring a special skill at one point of time will not be enough for ever long survival. Hence to flourish in the workplace and to bring in innovations in the ways of doing, employee, student as well as alumni must be continuous learners and tech savvy.
- *Diversity and Participation:* PBRVITS promotes the involvement of faculty, staff, and students from all social, economic, ethnics, cultural and religious backgrounds to get the synergy of combining the diversified agents. The focus is

on involving students to exhibit their talent in various curricular and co-curricular activities and strengthening alumni link to share their experiences to the students.

- *Academic Integrity and Accountability:* Management induces accountability in the employees for the career of the students and the academic leadership establishes a mentoring mechanism for realization of responsibilities of students towards their parents and in turn to the society.

MECHANICAL ENGINEERING

(For the batches admitted from the academic year 2021-22)

INDUCTION PROGRAM (3 weeks duration)

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

Semester I (First Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110101	Calculus and Special Functions	3	0	0	3	30	70	100
2	BS	21A110106	Engineering Physics	3	0	0	3	30	70	100
3	BS	21A110107	Engineering Chemistry	3	0	0	3	30	70	100
4	ES	21A050302	C-Programming & Data Structures	3	0	0	3	30	70	100
5	HSMC	21A110202	English for Professionals	2	0	0	2	30	70	100
6	BS	21A110109A	Engineering Physics Lab	0	0	3	1.5	30	70	100
7	BS	21A110109B	Engineering Chemistry Lab	0	0	3	1.5	30	70	100
8	ES	21A050303	C-Programming & Data Structures Lab	0	0	3	1.5	30	70	100
9	ES	21A050301	Engineering& IT Workshop Lab	0	0	3	1.5	30	70	100
Total							**20**			**900**

Semester II (First Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110110	Probability and Statistics	3	0	0	3	30	70	100
2	ES	21A030303	Material Science and Engineering	3	0	0	3	30	70	100
3	ES	21A030301	Engineering Drawing	1	0	4	3	30	70	100
4	ES	21A030302	Engineering Mechanics	3	0	0	3	30	70	100
5	ES	21A020303	Basic Electrical and Electronics Engineering	3	0	0	3	30	70	100
6	ES	21A020304	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
7	ES	21A030304	Material Science and Engineering Lab	0	0	3	1.5	30	70	100
8	HSMC	21A110201	Communicative English Lab	0	0	2	1	30	70	100
9	MC	21A000001	Environmental Science	2	0	0	0	30	-	-
Total							**19**			**800**

Semester III (Second Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110102	Mathematical Methods	3	0	0	3	30	70	100
2	ES	21A030305	Engineering Thermodynamics	3	0	0	3	30	70	100
3	ES	21A030306	Mechanics of Solids	3	0	0	3	30	70	100
4	PC	21A030401	Fluid Mechanics and Hydraulic Machinery	3	0	0	3	30	70	100
5	PC	21A030402	Manufacturing Processes	3	0	0	3	30	70	100
6	ES	21A030307	Mechanics of Solids Lab	0	0	3	1.5	30	70	100
7	PC	21A030403	Fluid Mechanics and Hydraulic Machinery Lab	0	0	3	1.5	30	70	100
8	PC	21A030404	Manufacturing Processes Lab	0	0	3	1.5	30	70	100
9	SC	21A030701	Solid Modeling	1	0	2	2	30	70	100
10	MC	21A000002	Constitution of India	2	0	0	0	30	-	-
Total							**21.5**			**900**

Semester IV (Second Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A030101	Operations Research	3	0	0	3	30	70	100
2	HSMC	21A110203	Managerial Economics & Financial Analysis	3	0	0	3	30	70	100
3	PC	21A030405	Applied Thermodynamics	3	0	0	3	30	70	100
4	PC	21A030406	Kinematics Of Machines	3	0	0	3	30	70	100
5	PC	21A030407	Machine Tools & Metrology	3	0	0	3	30	70	100
6	PC	21A030408	Applied Thermodynamics Lab	0	0	3	1.5	30	70	100
7	PC	21A030409	Machine Tools & Metrology Lab	0	0	3	1.5	30	70	100
8	PC	21A030410	Computer Aided Machine Drawing Lab	0	0	3	1.5	30	70	100
9	SC	21A050701	Python Programming	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship-I (Community Service Project) during semester break										

Semester V (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A030411	Dynamics of Machinery	3	0	0	3	30	70	100
2	PC	21A030412	Design of Machine Elements	3	0	0	3	30	70	100
3	PC	21A030413	Steam Engines & Gas Turbines	3	0	0	3	30	70	100
4	OE-I		**Open Elective - I**	3	0	0	3	30	70	100
5	PE-I	21A030414 21A030415 21A030416	**Professional Elective - I** a) Finite Element Methods b) Non Destructive Evaluation c) Mechanical Vibrations	3	0	0	3	30	70	100
6	PC	21A030417	Computer Aided Engineering Lab	0	0	3	1.5	30	70	100
7	PC	21A030418	Machine Dynamics Lab	0	0	3	1.5	30	70	100
8	SC	21A030702	Design Thinking and Product Innovation Lab	1	0	2	2	30	70	100
9	MC	21A000003	Universal Human Values	3	0	0	3	30	70	100
10	PROJ	21A030601	Internship-I Evaluation	-	-	-	1.5	-	-	100
Total							**24.5**			**1000**

Semester VI (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A030419	Heat Transfer	3	0	0	3	30	70	100
2	PC	21A030420	Mechatronics & Measurements	3	0	0	3	30	70	100
3	PC	21A030421	Design of Transmission Elements	3	0	0	3	30	70	100
4	PE-II	21A030422 21A030423 21A030424	**Professional Elective - II** a) Unconventional Machining Processes b) Automation in Manufacturing c) CAD/CAM	3	0	0	3	30	70	100
5	OE-II		**Open Elective - II**	3	0	0	3	30	70	100
6	PC	21A030425	Heat Transfer Lab	0	0	3	1.5	30	70	100
7	PC	21A030426	Advanced Machining Lab	0	0	3	1.5	30	70	100
8	PC	21A030427	Mechatronics & Measurements Lab	0	0	3	1.5	30	70	100
9	SC	21A030703	3D Modelling Using CREO	1	0	2	2	30	70	100
10	MC	21A000004	Research Methodology	2	0	0	0	30	---	---
Total							**21.5**			**900**
Internship-II (Industry) during semester break										

Semester VII (Fourth year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PE-III	 21A030428 21A030429 21A030430	**Professional Elective - III** a) Refrigeration and Air conditioning b) Automobile Engineering c) Non-Convectional Sources of Energy	3	0	0	3	30	70	100
2	PE-IV	 21A030431 21A030432 21A030433	**Professional Elective - IV** a) Power Plant Engineering b) Computational Fluid Dynamics c) Design & Optimization of Thermal Systems	3	0	0	3	30	70	100
3	PE-V	 21A030434 21A030435 21A030436	**Professional Elective - V** a) Principles of Industrial Engineering b) Production and Operation Management c) Total Quality Management	3	0	0	3	30	70	100
4	OE-III		**Open Elective - III**	3	0	0	3	30	70	100
5	OE-IV		**Open Elective - IV**	3	0	0	3	30	70	100
6	HSMC	21A110204	Management Science	3	0	0	3	30	70	100
7	SC	21A030704	Simulation Lab	1	0	2	2	30	70	100
8	PROJ	21A030602	Internship-II Evaluation	-	-	-	3	-	-	100
			Total				**23**			**800**

Semester VIII (Fourth year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PROJ	21A030603	Full Internship & Major Project	-	-	12	10	110	140	250
2	PROJ	21A030604	Technical Seminar	-	-	4	2	50	-	50
			Total				12			300

Open Elective – I

S. No	Course Code	Course Title
1	21A010501	Air Pollution and Control
2	21A020501	Electric Vehicles
3	21A020502	Electrical Distribution Systems
4	21A040501	Integrated Circuits and Applications
5	21A040502	Introduction to Signal Processing
6	21A050501	Operating Systems Concepts
7	21A050502	Computer Architecture & Organization

Open Elective – II

S. No	Course Code	Course Title
1	21A010502	Environmental Pollution and Control
2	21A020503	Smart Grid
3	21A020504	Energy Storage Systems
4	21A040503	Principles of Communication Systems
5	21A040504	Electronic Instrumentation
6	21A050503	Java Programming
7	21A050504	Basics of Database Management Systems

Open Elective – III

S. No	Course Code	Course Title
1	21A010503	Disaster Management and Mitigation
2	21A020505	Renewable Energy Systems
3	21A020506	Concepts of Electrical Drives and Applications
4	21A040505	Electronic Sensors
5	21A040506	Introduction to Image Processing
6	21A050505	Introduction to Internet of Things
7	21A050506	Web Technologies for Beginners

Open Elective – IV

S. No	Course Code	Course Title
1	21A010504	Cost Effective Housing Techniques
2	21A020507	Energy Conservation and Management
3	21A020508	Basics of Power Electronics
4	21A040507	Principles of Cellular and Mobile Communications
5	21A040508	Embedded Systems
6	21A050507	Cloud Computing – AWS
7	21A050508	Basics of Cryptography & Network Security

COURSES OFFERED FOR HONOURS DEGREE IN ME

S. No	Course Code	Course Title	Hours per week		Credits	CIE	SEE	Total
			L	T	C			
1	21A03HN01	Gear Engineering	3	1	4	30	70	100
2	21A03HN02	Fracture Fatigue and Creep Deformation	3	1	4	30	70	100
3	21A03HN03	Industrial Robotics and Expert Systems	3	1	4	30	70	100
4	21A03HN04	Applied Engineering Acoustics	3	1	4	30	70	100
5	21A03HN05	MOOC – 1	-	-	2	-	-	-
6	21A03HN06	MOOC – 2	-	-	2	-	-	-

LIST OF MINORS OFFERED TO ME

S. No	Course Code	Course Title	Department offering the course
1	21A040402	Pulse and Digital Circuits	ECE
2	21A040415	Data Communication and Networking	ECE
3	21A040433	Biomedical Signal Processing	ECE
4	21A040434	Radar Engineering	ECE
5	21A050415	Design and Analysis of Algorithms	CSE & ALLIED
6	21A050418	Mobile Computing	CSE & ALLIED
7	21A310402	Artificial Intelligence and Neural Networks	CSE & ALLIED
8	21A350401	Sensors and Internet of Things	CSE & ALLIED

Course Code	CALCULUS AND SPECIAL FUNCTIONS (Common to all branches)		L	T	P	C
21A110101			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course will illuminate the students in the concepts of calculus and Mean value theorems.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Utilize mean value theorems to real life problems.

CO2: Familiarize with functions of several variables which is useful in optimization.

CO3: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems.

CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 3- dimensional coordinate systems.

CO5: Utilize special functions in evaluating definite integrals.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (10 Hrs)

Mean Value Theorems: Rolle’s Theorem, Lagrange’s mean value theorem, Cauchy’s mean value theorem, Taylor’s and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as series of Taylor’s and Maclaurin’s with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT – II (12 Hrs)

Multi variable calculus: Partial derivatives, total derivatives, chain rule, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes: At the end of this unit, students should be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

UNIT – III (10 Hrs)

Double Integrals: Evaluation of Double integrals, change of order of integration, change of variables. Areas using Double Integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

UNIT – IV (10 Hrs)

Triple Integrals: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volumes using triple integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate triple integrals in Cartesian, cylindrical and spherical polar coordinates. (L5)
- Apply triple integration techniques in evaluating volumes. (L4)

UNIT – V (12 Hrs)

Beta and Gamma functions: Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

TEXTBOOKS:

1. "Higher Engineering Mathematics", S. Grewal, Khanna Publishers, 44/e, 2017.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.
2. "Calculus", George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
3. "Advanced Modern Engineering Mathematics", Glyn James, Pearson publishers, 4/e, 2011.
4. "Advanced Engineering Mathematics", Michael Greenberg, Pearson Education, 9th Edition.
5. "Advanced Engineering Mathematics with MATLAB", Dean G. Duffy, CRC Press
6. "Advanced Engineering Mathematics", Peter O'Neil, Cengage Learning.
7. "Engineering Mathematics Volumes-I &II", R.L. Garg Nishu Gupta, Pearson Education
8. "Higher Engineering Mathematics", B. V. Ramana, McGraw Hill Education
9. "Higher Engineering Mathematics", H. K. Das, Er. Rajnish Verma, S. Chand & Co. Ltd.
10. "Advanced Engineering Mathematics", N. Bali, M. Goyal, C. Watkins, Infinity Science Press.
11. "Engineering Mathematics", T.K.V Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications.

Course Code	ENGINEERING PHYSICS (Common to CE, ME, CSE-IOT, CSE-AI, AIML)		L	T	P	C
21A110106			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To present the basic concepts needed to understand the crystal structure of materials, X- ray diffraction and the importance of nano materials.
- To understand the mechanisms of lasers and propagation of light through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To explain the significance of acoustics and ultrasound in different engineering fields.
- Evolution of band theory to distinguish materials and explain the properties of semiconductors.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Explain the important properties of crystals & structure determination using X-ray Diffraction along with the nano materials.
CO2: Identify the importance of lasers and fiber optics in different engineering fields
CO3: Understand the response of dielectric & magnetic materials to the applied electric & magnetic fields
CO4: Explain the basic concepts of acoustics and ultrasonics.
CO5: Elaborate the physical properties of semiconductors.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Crystallography & Nano materials

Crystallography: Introduction – Space lattice – Unit cell – Lattice parameters – Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Laue Method - Powder method.

Nano materials – Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball

Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

Learning Outcomes: At the end of this unit, students should be able to

- Classify various crystal systems (L2)
- Identify different planes in the crystal structure (L3)
- Analyze the crystalline structure by Bragg's law to measure the crystallinity of a solid by powder method (L4)
- Identify the nano size dependent properties of nano materials (L2)
- Illustrate the methods for the synthesis and characterization of nano materials (L2)

UNIT - II (12 Hrs)

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Transmission of signals in step index and graded index fibers – Propagation Losses (qualitative) – Applications of fiber in medical field .

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

UNIT – III (12 Hrs)

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius - Mosotti relation in dielectrics (L2)

- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
- Explain the applications of dielectric and magnetic materials (L2)

UNIT - IV (13 Hrs)

Acoustics and Ultrasonics

Acoustics- Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine’s formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

Ultrasonics- Introduction – Properties – Production by magneto striction and piezoelectric methods – Detection – Acoustic grating – Non Destructive Testing – Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain how sound is propagated in buildings (L2)
- Analyze acoustic properties of typically used materials in buildings (L4)
- Recognize sound level disruptors and their use in architectural acoustics (L2)
- Identify the use of ultrasonics in different fields (L3)

UNIT - V (13 Hrs)

Semiconductors- Origin of energy bands - Classification of solids into conductors, semiconductors and insulators -Intrinsic and extrinsic semiconductors (Qualitative treatment)– Density of carriers and Fermi levels in intrinsic & extrinsic semiconductors Drift & diffusion currents and Einstein’s equation – Hall effect - Direct and indirect band gap semiconductors.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)

TEXTBOOKS:

1. “Engineering Physics”, Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, S. Chand and Company
2. “Engineering Physics”, B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. “Engineering Physics”, K. Thyagarajan, McGraw Hill Publishers

REFERENCE BOOKS:

1. "Engineering Physics", Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. "Engineering Physics", Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
3. "Semiconductor physics and devices - Basic principles", Donald A, Neamen, McGraw Hill
4. "Engineering physics", P.K. Palanisamy, SCITECH Publications
5. "Applied Physics", S. Mani Naidu, Pearson Publications
6. "Lasers and Non-Linear Optics", B.B Laud, New Age International Publishers.

Course Code	ENGINEERING CHEMISTRY		L	T	P	C
21A110107	(Common to CE, ME)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard water, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers and advanced engineering materials

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the hardness of water through its softening techniques for domestically and industrially.

CO2: Apply the knowledge of various electrochemical cells for the development of new batteries and explain the reasons for corrosion and its control methods.

CO3: Differentiate the types of Plastomers and elastomers; apply the knowledge effective usage in daily life.

CO4: Explain the origin of fuel and their economic advantages.

CO5: Apply the knowledge of different modern materials used in engineering field.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1
CO2	3	-	-	-	2	-	-	-	-	-	-	-	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CO4	3	1	-	-	-	-	-	-	-	-	-	-	2	2
CO5	3	2	-	-	2	-	-	-	-	-	-	-	1	1

UNIT-I (14 Hrs)

Water Technology: Introduction –Soft Water and hardness of water, Estimation of hardness of water by EDTA Method –Boiler troubles–Priming, foaming**,** sludge and scale, Caustic embrittlement, Industrial waste water treatment specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO)standards, ion-exchange processes-desalination of brackish water, reverse osmosis (RO) and electro dialysis.

Learning Outcomes: At the end of this unit, students should be able to

- List the differences between temporary and permanent hardness of water(L1)
- Explain the principles of reverse osmosis and electro dialysis. (L2)
- Compare quality of drinking water with BIS and WHO standards. (L2)
- Illustrate problems associated with hard water – sludge and scale. (L2)

- Explain the working principles of different Industrial water treatment processes (L2)

UNIT-II (13 Hrs)

Electrochemistry and Applications: Electrodes–concepts, electrochemical cell, Nernst equation, cell potential calculations. Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (Ni-Cd),and lithium ion batteries-working of the batteries including cell reactions; Fuel cells- hydrogen-oxygen, methanol-oxygen fuel cells –working of the cells.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling-Bed worth ratios and uses, Factors affecting the corrosion, prevention of corrosion by cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Nernst equation for calculating electrode and cell potentials (L3)
- Apply Pilling-Bedworth rule for corrosion and corrosion prevention (L3)
- Demonstrate the corrosion prevention methods and factors affecting corrosion (L2)
- Compare different batteries and their applications (L2)

UNIT-III (13 Hrs)

Polymers: Introduction to polymers, functionality of monomers, Classification of polymerization. Plastomers - Thermoplastics and Thermo-setting plastics- Preparation, properties and applications of poly styrene, PVC and Bakelite.

Elastomers: Natural rubber, Processing of natural rubber, vulcanization, compounding of rubber. Synthetic rubber: Preparation, properties and applications of Buna-S, Buna-N and Thiokol rubber.

Learning Outcomes: At the end of this unit, students should be able to

- Explain different types of polymers and their applications (L2)

UNIT-IV (10 Hrs)

Fuel Technology: Fuels – classification and their characteristics**,** calorific value - units, Solid fuels – Coal – classification, Analysis of coal, Liquid Fuels- refining of petroleum, Synthetic petrol: Bergius process, Fischer-Troph's process. Fuels for IC engines, knocking and anti-knocking agents, Octane and Cetane numbers, Gaseous Fuels- Flue gas analysis by Orsat's apparatus.

Learning Outcomes: At the end of this unit, students should be able to

- Select suitable fuels for IC engines (L3)
- Explain calorific values, octane number, refining of petroleum (L2)

UNIT-V (10 Hrs)

Modern Engineering Materials: Nano material's: Introduction, classification, properties and applications of fullerenes, carbon nanotubes and Graphene nanoparticles.

Refractories: Classification, Properties, Factors affecting the refractory materials and Applications.

Lubricants-Classification, Functions of lubricants, Mechanism, Properties of lubricating oils–Viscosity, Viscosity Index, Flashpoint, and Fire point, Cloud point, saponification of oil and Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate the applications of fullerenes, carbon nanotubes and Graphene nanoparticles (L2)
- Identify the factors affecting the refractory material (L3)
- Illustrate the functions and properties of lubricants (L2)

TEXTBOOKS:

1. "Engineering Chemistry", Jain and Jain, Dhanpat Rai publications,17/e, 2018.
2. "A textbook of Engineering Chemistry" Dr. SS Dara, Dr. SS Umare, S. Chand publications, 12/e, 2010.
3. "A textbook of Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2010.

REFERENCE BOOKS:

1. "Concise Inorganic Chemistry", J. D. Lee, Oxford University Press, 5/e, 2008
2. "Engineering Chemistry", G. V. Subba Reddy, K. N. Jayaveera and Ramachandraiah, McGraw Hill, 2020.

Course Code	C-PROGRAMMING & DATA STRUCTURES		L	T	P	C
21A050302	(Common to all branches)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- Demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C using Arrays and Strings.
CO3: Modularize the problem and also solution.
CO4: Design applications in C using Functions, Pointers, and Structures.
CO5: Explore various operations on Stacks, Queues and Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Computer Fundamentals, Algorithm, Flowchart.

Introduction to C Language: Characteristics, Identifiers, Constants, Data types, Keywords, Basic input/output statements, Structure of a C program.

Operators and Expressions: Operators classification, Assignment Operator, Arithmetic Operators, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators with examples – Operator precedence and Associativity, Type casting.

Statements: Simple and Compound statements, Control Statements - Conditional/Decision statements, Loop Control Statements, Branch Control statements.

Learning Outcomes: At the end of this unit, students should be able to

- Solve complex problems using language independent notations (L3)
- Use C basic concepts to write simple C programs (L3)
- Test and execute the programs and correct syntax and logical errors (L4)
- Select the control structure for solving the problem (L4)
- Implement conditional branching, iterations (L2)

UNIT-II (12 Hrs)

Arrays: Declarations, Initialization and accessing elements, Single, Two and Multi-dimensional arrays.

Array Techniques: Array order reversal, finding the maximum and minimum number in a set, sorting the given array elements.

Strings: String I/O functions, String handling functions, Data conversion functions.

Learning Outcomes: At the end of this unit, students should be able to

- Use arrays to process multiple homogeneous data (L3)
- Solve mathematical problems using C Programming languages (L3)
- Apply string handling functions (L3)

UNIT-III (12 Hrs)

Functions: Types of functions, Library functions, User-defined functions, Function Categories, Nested functions, Recursion, Symbolic constants, Pre-processor Commands, Storage classes – auto, register, static, extern, Type qualifiers.

Input and output: Standard input and output, Non-formatted Input and Output statements, Formatted Input and Output statements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of modular programming (L2)
- Apply modular approach for solving the problem (L3)
- Writing C programs using various storage classes to control variable access (L5)
- Apply input and output statements to process the data in various formats (L3)

UNIT-IV (12 Hrs)

Pointers: Pointers and addresses, Passing parameters to functions, Address Arithmetic operations, Void and Null pointers, Pointer and Arrays, Pointer and Strings, Array of Pointers, Pointer and Functions, Pointer-to-Pointer, Dynamic Memory Allocation. Uses of Pointers, Command line Arguments.

Structure and Union: Declaration and Initialization of a structure, Copy and comparisons, Array of structures, Structure with pointer, Nested structures, Type Definition, Enumeration, Union.

Learning Outcomes: At the end of this unit, students should be able to

- Structure the individual data elements to simplify the solutions (L6)
- Facilitate efficient memory utilization (L6)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT-V (14 Hrs)

Data Structures: Overview of data structures, **Stack:** Representation of a stack, Operations and Applications of a Stack – Evaluation of Arithmetic Expressions, Implementation of Recursion – **Queue:** Representation of a queue, Operations and Applications of a Queue – CPU Scheduling in Multi-programming Environment.

Linked List: Representations of linked lists, singly linked list, doubly linked list, Circular linked list and its operations.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the operations of a stack (L2)
- Develop various operations on Queues (L6)
- Analyze various operations on singly linked list (L4)
- Interpret operations of doubly linked lists (L2)
- Apply various operations on Circular linked lists (L6)

TEXTBOOKS:

1. "The Complete Reference C", Herbert Schildt, McGraw Hill Education, Fourth Edition
2. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
3. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition
2. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition

Course Code	ENGLISH FOR PROFESSIONALS		L	T	P	C
21A110202	(Common to all branches)		**2**	**0**	**0**	**2**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To improve Reading and Writing proficiency of students in English with an emphasis on Vocabulary development.
- To provide knowledge of grammatical structures and encourage their appropriate use in writing.
- To improve students' comprehension skills required for academic and professional needs.
- To equip students with writing skills required for professional correspondence in different contexts.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate word knowledge and its usage in appropriate contexts.
CO2: Recognize and incorporate basic grammar mechanics and sentence variety in writing.
CO3: Improve comprehension skills through intensive and extensive reading practice.
CO4: Learn and apply various writing formats for effective communication.
CO5: Improve writing skills needed for professional correspondence in various contexts.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

UNIT-I (10 Hrs)

Vocabulary Building: Introduction to affixes and base words, Prefixes and suffixes, Basic comparing and contrasting, Idioms and Phrases, One word substitutes, Words often confused, Synonyms and Antonyms used in the everyday contexts, Using prior knowledge to determine the correct word for the context, Discovering the correct word in the sentence by looking at the surrounding words, Vocabulary in social interactions.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize word parts: affixes, prefixes, suffixes and base words. (L2)
- Use words appropriately in a context. (L3)
- Guess the meanings of the words by using the contextual clues. (L2)
- Use synonyms, antonyms, phrases and idioms in writing. (L2)

UNIT-II (10 Hrs)
Essentials of Sentence Formation: Basic Sentence Structure, word order, Subject-Verb Concord, Using Tenses, Punctuation Marks, Correction of Common Errors
Learning Outcomes: At the end of this unit, students should be able to
- Frame a sentence without any grammatical errors. (L3)
- Use appropriate punctuation marks. (L3)
- Identify common errors in a sentence. (L2)

UNIT-III (10 Hrs)
Reading Comprehension: Understanding short real-world notices, messages, factual material - Scanning, skimming - Inferring meaning - Critical reading - Reading and information transfer
Learning Outcomes: At the end of this unit, students should be able to
- Use skimming and scanning strategies while reading. (L3)
- Infer meaning from the given text. (L3)
- Distinguish between the main idea and supporting ideas. (L3)
- Critically analyse the given text. (L4)

UNIT-IV (10 Hrs)
Writing Skills: Rules for good writing and composition; Paragraph Writing: Structure of a paragraph, Types of paragraphs, Usage of Cohesive Devices; Essay writing: Structure of an Essay, Types of Essays; Letter Writing (Formal and informal): Format and Structure; and Email writing
Learning Outcomes: At the end of this unit, students should be able to
- Learn to organize thoughts into meaningful paragraphs. (L2)
- Use cohesive devices in making the piece of writing more coherent. (L3)
- Compose essays on different topics in a more organised structure. (L3)
- Draft letter and emails in a definite format. (L3)

UNIT-V (10 Hrs)
Professional Correspondence: Internal Correspondences – Memorandum, Note Taking, Minutes of Meetings; External Correspondences - Business Letters - Cover Letters - Sale Letters - Inquiry Letters - Complaint Letters - Emails & Netiquette
Learning Outcomes: At the end of this unit, students should be able to
- Draft official e-mails and letters for different professional purposes. (L3)
  Write proficiently memos and minutes of meeting. (L3)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://digital.library.upenn.edu/women/sultana/dream/dream.html
2. https://owl.purdue.edu/
3. https://www.thesaurus.com/
4. https://www.readwritethink.org/classroom-resources/student-interactives
5. https://www.fluentu.com/blog/english/english-writing-websites/

Course Code	ENGINEERING PHYSICS LAB		L	T	P	C
21A110109A	(Common to CE, ME, CSE-IOT, CSE-AI, AIML)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its application in finding the wavelength.
- Understands the concepts of interference, diffraction and their applications.
- Verify the Laws of Stretched Strings by sonometer.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Operate various optical instruments
CO2: Estimate wavelength of laser using laser
CO3: Evaluate the acceptance angle of an optical fiber and numerical aperture
CO4: Plot the intensity of the magnetic field of circular coil carrying current with distance

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	-

LIST OF EXPERIMENTS

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of wavelength of LASER light using diffraction grating.
5. Determination of numerical aperture and acceptance angle of a given optical fiber
6. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
7. Sonometer: Verification of the three laws of stretched strings
8. Determination of particle size using LASER.
9. Study the variation of B versus H by magnetizing the magnetic material. (B-H curve)
10. Determination of rigidity modulus of material of a wire -dynamic method. (Torsional Pendulum)

REFERENCE BOOKS:

1. "A Textbook of Practical Physics", S. Balasubramanian, M.N. Srinivasan, S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Code	ENGINEERING CHEMISTRY LAB		L	T	P	C
21A110109B	(Common to CE, ME)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of Engineering Chemistry.
- To verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop skills in determining the effects of hardness of water.
CO2: Distinguish different types of titrations in the volumetric analysis.
CO3: Determine the cell constant and conductance of solutions.
CO4: Analyze the effect of temperature on viscosity by using Redwood viscometer.
CO5: Prepare advanced polymer Thiokol rubber materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	1	-
CO5	3	2	-	-	1	-	-	-	-	-	-	-	2	-

LIST OF EXPERIMENTS:

1. Preparation of standard Magnesium sulphate solution
2. Determination of Total Hardness of Ground Water by EDTA Titration Method
3. Determination of Strength of an acid in Lead-Acid battery
4. Conductometry- Determination of cell constant and conductance of solutions.
5. Potentiometry- determination of redox potentials and emf’s
6. PH-metric titration of a) strong acid vs strong base b) weak acid vs strong base
7. Determination of the rate of corrosion in Iron sample
8. Determination of percentage moister content in a Coal sample.
9. Determination of Viscosity of lubricating oil by Redwood Viscometer No-I&II
10. Determination of calorific value of gases by Junker’s gas calorimeter
11. Preparation of Thiokol rubber.
12. Preparation of nanomaterial’s

TEXTBOOKS:

1. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014.
2. "Experiments in Applied Chemistry", Dr. Sunita Rattan, S. K. Kataria & Sons Publishers of Engineering, 2/e, 2004.

REFERENCE BOOKS:

1. "Vogel's Text Book of Quantitative Chemical Analysis", Mendham J et.al, Pearson Education, 6/e, 2012.

Course Code	C-PROGRAMMING & DATA STRUCTURES LAB (Common to all branches)		L	T	P	C
21A050303			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of C Programming
- To make the student solve problems, implement algorithms using C language
- To design programs using arrays, strings, pointers and structures
- To design Stack and Queue operations
- To apply different operations o linked lists

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Demonstrate the basic concepts of C programming language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs using functions, arrays, structures and pointers.
CO4: Illustrate the concepts Stacks and Queues.
CO5: Design operations on Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

Week 1

a) Write a C program to swap the given two integer values without using temporary variable.
b) Write a C program to print the first ‘N’ Fibonacci sequence numbers.

Week 2

a) Write a C program to print reverse of a given integer value.
b) Write a C program to find the roots of a quadratic equation.

Week 3

Write a C program that use recursive functions.

i) GCD of given two values.
ii) Factorial of a given value.

Week 4

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program to perform the following:

i) Addition of Two matrices ii) Multiplication of Two matrices

Week 5

a) Write a C program that displays the position or index in the string S where the string T begins or -1 if S doesn't contain T.

b) Write a C program to read a set of strings and sort them in alphabetical order.

Week 6

a) Write a C program to count number of alphabets, digits and special symbols of a given line.

b) Write a C program to check whether a given string is palindrome or not.

Week 7

Write a C program to demonstrate the difference between call-by-value and call-by-address mechanisms.

Week 8

Write a program to perform the operations addition, subtraction, multiplication of complex numbers.

Week 9

Write a C program that implement stack operations using arrays.

Week 10

a) Write a C program that implement linear queue operations using arrays.

b) Write a C program that implement circular queue operations using arrays.

Week 11

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on doubly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following operations on circular linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

TEXTBOOKS:

1. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
2. "Computer Science: A Structured Programming Approach Using C", B.A. Forouzon and R.F. Gilberg, CENGAGE Learning, Third Edition, 2016.
3. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition,
2. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.

Course Code	ENGINEERING & IT WORKSHOP LAB		L	T	P	C
21A050301	(Common to all branches)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

PART-A (ENGINEERING WORKSHOP)

COURSE OBJECTIVES:

- To familiarize the students with wood working, sheet metal operations, fitting and electrical house, Wiring and foundry skills.
- To provide technical training to the students on Word, Excel and Presentation.
- To make the students know about the internal parts of a computer.
- To learn how to use Internet facility for Browsing and Searching.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply wood working skills and build different parts with metal sheets in real world applications.
CO2: Apply fitting operations in various applications and Preparation of moulds and castings.
CO3: Apply different types of basic electric circuit connections.
CO4: Prepare documentation, spread sheets for calculations and slides for Presentation.
CO5: Identify Computer peripherals and its functions, Internet browsing to obtain the required information

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	1	-
CO2	3	2	2	-	-	2	-	-	-	-	-	2	1	-
CO3	3	2	-	-	-	2	-	-	-	-	-	2	1	2
CO4	3	-	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

LIST OF TOPICS:

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints
a) Half – Lap joint b) Dovetail joint or Bridle joint
Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets
a) Tapered tray b) Conical funnel
Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises
a) V-fit b) Square fit.

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting

Foundry:

a) Preparation of mould cavity using single piece pattern.
b) Preparation of mould cavity using split piece pattern

PART-B (IT WORKSHOP)

LIST OF TOPICS:

Task 1:

MS-Word: Students should be able to create documents using the word processor tool. Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit report.

Task 2:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 3:

Presentations: creating, opening, saving the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, running the slide show.

Task 4: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 5:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.

REFERENCE BOOKS:

1. "Workshop Practice Manual", K. Venkata Reddy, BS Publications.
2. "Engineering work shop practice for JNTU", V. Ramesh babu, VRB Publishers Pvt. Ltd., 2009.
3. "Work shop manual", P. Kannaiah, K. L. Narayana, SCITECH Publishers.
4. "Engineering practices lab manual", Jeyapoovan, Saravanapandian, Vikas Publishing House, 4/E
5. "Dictionary of mechanical engineering", GHF Nayler, Jaico Publishing House.
6. "Introduction to Computers", Peter Norton, McGraw Hill
7. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox.
8. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
9. "Networking your computers and devices", Rusen, Prentice Hall of India
10. "Bigelow's Trouble shooting, Maintaining & Repairing PCs", Bigelow, Tata McGraw Hill Edition

Course Code	PROBABILITY AND STATISTICS (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110110			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize the students with the foundations of probability and statistical methods.
- To impart probability concepts and statistical methods in various applications Engineering.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Solve the central tendency, correlation and correlation coefficient and regression

CO2: Understand the terminologies of basic probability, two types of random variables and their probability functions.

CO3: Interpret the behavior of various discrete and continuous probability distributions.

CO4: Apply the concept of hypothesis testing for large samples.

CO5: Apply the statistics for testing the significance of the given small sample data by using t- test, F- test and Chi-square test.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	3	-	-	-	-	-	1	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Statistics Introduction, Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, regression lines, regression coefficients and their properties

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the basic concepts of data science and its importance in engineering (L2)
- Analyze the data quantitatively or categorically, measure of averages, variability (L4)
- Adopt correlation methods and regression analysis (L5)

UNIT-II (11 Hrs)

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Bayes theorem, random variables (discrete and continuous), probability density functions, properties.

Learning Outcomes: At the end of this unit, students should be able to

- Define the terms trial, events, sample space, probability, and laws of probability (L1)
- Make use of probabilities of events in finite sample spaces from experiments (L3)
- Apply Bayes theorem to real time problems (L3)
- Explain the notion of random variable, distribution functions and expected value (L2)

UNIT-III (12 Hrs)

Probability distributions: Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (L3)
- Interpret the properties of normal distribution and its applications (L2)

UNIT-IV (11 Hrs)

Estimation and Testing of hypothesis, large sample tests: Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of estimation, interval estimation and confidence intervals (L2)
- Apply the concept of hypothesis testing for large samples (L4)

UNIT-V (11 Hrs)

Small sample tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the concept of testing hypothesis for small samples to draw the inferences (L3)
- Estimate the goodness of fit (L5)

TEXTBOOKS:

1. "Miller and Freund's Probability and Statistics for Engineers", Richard A. Johnson, Pearson, 7/e, 2008.

2. “Fundamentals of Mathematical Statistics”, S.C. Gupta and V.K. Kapoor, S. Chand & Sons Publications, 11/e, 2012.

REFERENCE BOOKS:

1. “A First Course in Probability”, S. Ross, Pearson Education India, 2002.
2. “An Introduction to Probability Theory and its Applications”, W. Feller, Wiley Publications, 1/e, 1968.
3. “Probability, Random Variables & Random Signal Principles”, Peyton Z. Peebles, McGraw Hill Education, 4/e, 2001.

Course Code	MATERIAL SCIENCE AND ENGINEERING		L	T	P	C
21A030303			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize with the fundamentals of solidification, phase diagrams, heat treatment and properties of metallic and non-metallic materials.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate crystallization and grain growth of metals and identify the effect of alloying elements and invariant reactions on the behaviour of metals.

CO2: Analyze the structure, properties and applications of steels and cast irons.

CO3: Choose a suitable heat treatment process to impart desired properties of metals.

CO4: Appraise nature of non-ferrous & ceramic materials.

CO5: List out the engineering applications composites and nano materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	-	2	2	-	-	-	-	1	2	-
CO2	3	2	3	-	-	2	2	-	-	-	-	-	3	2
CO3	3	-	3	2	-	2	2	-	-	-	-	-	2	1
CO4	3	-	2	2	-	2	2	-	-	-	-	-	2	2
CO5	3	-	3	2	1	2	2	-	-	-	-	-	2	3

UNIT-I (14 Hrs)

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions.

Phase Diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-Iron-carbide diagram and micro structural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of material science in engineering. (L2)
- Recall the definitions and terminology of crystallography (L2).
- Distinguish metals and alloys (L4).
- Make use of the principles of construction of binary phase diagrams (L3).
- Identify various invariant reactions in binary phase diagrams (L3).

- Explain the concept of metallography in studying the microstructures of metals and alloys (L2).

UNIT-II (10 Hrs)

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels, Classification of alloys steels. Microstructure, properties and applications of alloy steels, stainless steels and tool steels.

Cast irons: Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, modular cast iron and alloy cast irons.

Learning Outcomes: At the end of this unit, students should be able to

- Classify various types of steels, their properties and applications(L2).
- Identify various types of cast irons, their properties and applications(L3).
- Compare steels and cast irons and their limitations in applications(L3).

UNIT-III (12 Hrs)

Heat Treating of Steels: TTT curves, continuous cooling curves, heat treatment processes – annealing, normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods - carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of steel and iron - iron carbide phase diagram(L2).
- Explain the influence of heat treatment in modification of properties of steels(L2).
- Develop a heat treatment cycle based on properties required(L3).
- Explain the principles of surface hardening methods(L2).

UNIT-IV (10 Hrs)

Non- Ferrous Metals and Alloys: Properties and applications of titanium - titanium alloys, copper – copper alloys, and aluminium – aluminium alloys.

Ceramics: Structure, properties and applications of ceramics.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of non-ferrous metals and alloys in engineering applications(L2).
- Demonstrate various properties and applications of non-ferrous alloys(L4).
- Explain the properties of ceramics and their applications(L2).

UNIT-V (14 Hrs)

Composite materials: Classification of composites, various methods to manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal – matrix composites and C – C composites.

Nano Materials: Introduction-properties at nano scales-advantages & disadvantages applications in comparison with bulk materials.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the properties of polymers and composites and their use(L2).
- Interpret the properties of nano materials and their applications(L2).
- Identify the difference between the micro and nano scale materials and their uses(L3).

TEXTBOOKS:

1. "Introduction to physical metallurgy", Sidney H. Avner, Tata Mc Graw Hill Publications, 2nd Edition.
2. "Essential of Materials science and engineering", Donald R. Askeland and Wendelin J. Wright, CL Engineering publications, 2nd Edition.
3. "An Introduction to Metallurgy", Sir Alan Cottrell, Universities Press, 2nd Edition

REFERENCE BOOKS:

1. "Material science and Metallurgy for Engineers", V. D. Kodgire, S.V Kodgire, Everest publishing house, 42nd Edition.
2. "Science of engineering materials", Agarwal, S. Chand Publications.
3. "Materials science and engineering - An Introduction", William D. collister, David G. Rethwich, Loose leaf publications, 8th Edition.
4. "Nano materials", A.K. Bandyopadyay, New age Publishers.

Course Code	ENGINEERING DRAWING (Common to all branches)		L	T	P	C
21A030301			1	0	4	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.
- Instruct graphical representation of machine components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Construction of various conic curves, Cycloid curves
CO2: Construction of projections of Points, Lines applied in engineering
CO3: Construction of projections of Planes.
CO4: Construction of projection of solids development of surfaces regular Solids.
CO5: Representation of Ortho and Isometric views of solids.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO4	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO5	3	2	2	-	3	-	-	-	-	2	-	2	2	2

UNIT-I (12 Hrs)

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance - Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, Epi-cycloid and Hypocycloid - general method only.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of engineering drawing (L2)
- Know the conventions used in the engineering drawing (L1)
- Identify the curves obtained in different conic sections (L2)
- Draw different cycloidal curves. (L3)

UNIT– II (12 Hrs)
Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, true angle made by line.
Learning Outcomes: At the end of this unit, students should be able to
- Know how to draw the projections of points, lines (L1)
- Find the true length of the lines. (L2)

UNIT-III (18 Hrs)
Projection of planes: Projections of regular plane inclined to both the planes and also draw the projections of different planes in Computerized drawing.
Learning Outcomes: At the end of this unit, students should be able to
- Understand the procedure to draw projection of planes. (L2)
- Draw the projection of plane inclined to one plane and both the planes. (L3)
- Understand the different commands used in Computerized drawing to draw different planes. (L2)

UNIT- IV (15 Hrs)
Projections of solids: Projections of regular solids inclined to one or both planes by rotational method.
Development of Solids: Development of lateral Surfaces of Right Regular Solids (without section)-Prism, Cylinder, Pyramid, Cone.
Learning Outcomes: At the end of this unit, students should be able to
- Understand the procedure to draw projection of solids. (L2)
- Draw the projection of solid inclined to one plane. (L3)
- Draw the projection of solids inclined to both the planes. (L3)

UNIT–V (18 Hrs)
Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Conversion of Isometric Views to Orthographic Views. Drawing the Isometric views using Computerized drawing.
Learning Outcomes: At the end of this unit, students should be able to
- Learn the basics convectional representation of different projections (L1)
- Draw the Orthographic projection of simple solids. (L3)
- Draw the Isometric projection of simple solids. (L3)

TEXTBOOKS:

1. “Engineering Drawing”, K. L. Narayana & P. Kannaiah, SciTech Publishers, Chennai, 3/e.
2. “Engineering Drawing + AutoCAD”, K. Venugopal, V. Prabhu Raja, New Age Publishers.
3. “Engineering Drawing”, N. D. Bhatt, Charotar Publishers, 53/e, 2016

REFERENCE BOOKS:

1. “Engineering Drawing”, Dhanajay A Jolhe, Tata McGraw-Hill, Copy Right, 2009.
2. “Engineering Drawing”, Basant Agarwal & C. M. Agarwal, Tata McGraw-Hill
3. “Engineering Drawing”, Shah and Rana, Pearson Education, 2/e, 2009

Course Code	ENGINEERING MECHANICS		L	T	P	C
21A030302	(Common to EEE & ME)		3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- Develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.
- To learn the effect of friction on equilibrium.
- To learn kinematics, kinetics of particle and rigid body, related principles.
- Understand Moment of force, Varignon's theorem with applications, couple.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

CO2: Analyze the forces in the members of the frames/truss.

CO3: Understand the concept of friction and its applications.

CO4: Understand the concept of centroid and location of centroid of plane figures and material bodies.

CO5: Understand moment of inertia, determining moment of inertia of plane figures and material bodies.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	3	-	-	-	-	-	2	2
CO2	2	3	3	1	1	-	-	-	-	-	-	-	2	2
CO3	3	3	2	1	1	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	1	-	-	-	-	-	-	-	1	1
CO5	3	2	3	2	2	-	-	-	-	-	-	-	1	1

UNIT-I (12 Hrs)

Introduction to Engineering Mechanics: Basic concepts - System of forces–Resultant of a force system, Moment of forces and its Application & Couples, Spatial Forces-Components in space, Resultant Equilibrium of system forces, free body diagrams.

Types of Supports: Support reactions for beams with different types of loading – concentrated, uniformly distributed load, uniformly varying loading and couple.

Learning Outcomes: At the end of this unit, students should be able to

- Use scalar and vector analytical techniques for analyzing forces (L4)
- Calculate resultant and apply conditions of equilibrium. (L3)
- Demonstrate knowledge of mathematics and mechanics with logics in resolution and composition of force systems. (L3)

UNIT-II (14 Hrs)

Analysis of Perfect Frames: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, Tension Coefficient method and methods of sections for vertical loads, horizontal loads and inclined loads.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand types of frames and analyze for the forces in the members of the truss by method of joints and method of sections. (L4)
- Analysis of truss, cable, frame and friction. (L4)
- Identify the type of frame and analyze for the forces in the members of the truss (frame) by method of joints and method of sections. (L4)

UNIT-III (12 Hrs)

Friction: Types of friction– Static and Dynamic Frictions, laws of Friction–Limiting friction and impending motions–Cone of limiting friction– Motion of bodies – Wedge friction – Screw jack.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand the basic concepts of friction(L2)
- Understand various types of friction. (L2)
- Apply type motions and also understand, applications of friction. (L3)

UNIT-IV (16Hrs)

Centroid and Centre of Gravity: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies -Centre of Gravity of Composite figures. (Simple problems only).

Moment of Inertia: Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures. Moment of Inertia of Simple solids, Moment of Inertia of composite masses. (Simple problems only).

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand distributed force systems, centroid center of gravity and method of finding centroids of composite figures and bodies. (L2).
- Understand the moment of inertia and method of finding moment of inertia of areas and bodies. (L2)
- Understand the mass moment of inertia of different solid materials. (L2)

UNIT-V (14 Hrs)

Kinematics: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of A Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies

***Learning Outcomes**:* At the end of this unit, students should be able to

- Able to understand practical examples related to curvilinear motion. (L2)
- Ability to relate kinematics with kinetic equations on linear displacement, velocity and acceleration. (L4)
- Understand the work energy, energy, power, potential energy (L2)
- Understand Kinetics of rigid body rotation. (L2)

TEXTBOOKS:

1. "Engineering Mechanics-Statics and Dynamics", A. Nelson, Tata McGraw Hill Company.
2. "Engineering Mechanics", R.K Bansal, Laxmi Publications
3. "Engineering Mechanics", Bhavikatti and Rajasekharappa

REFERENCE BOOKS:

1. "Engineering Mechanics", S. Timoshenko, D. H. Young and J. V. Rao, Tata McGraw Hill Company
2. "Engineering Mechanics", Ferdinand L. Singer, Harper Collings Publishers

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A020303			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To teach DC and AC electrical circuit analysis
- To explain working principles of transformers and electrical machines
- To impart knowledge on Power system generation, transmission and distribution
- Familiar with the theory, construction, and operation of electronic devices
- Learn about biasing of BJTs and FETs.
- Design and construct amplifiers, understand the concept & principles of logic devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply concepts of KVL/KCL in solving DC circuits
CO2: Illustrate working principles of DC Motor, Transformer and Induction motors
CO3: Understand the basics of Power generation, Transmission and Distribution
CO4: Explain the theory, construction, operation and working of electronic devices.
CO5: Analyze and design small signal amplifier circuits, logic gate, combinational and sequential circuits

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

Part A: Basic Electrical Engineering

UNIT-I (10 Hrs)

DC & AC Circuits: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms -peak and rms values - phasor representation - real power - reactive power - apparent power – power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

Learning Outcomes: At the end of this unit, students should be able to

- Recall Kirchoff laws (L1)

- Analyze simple electric circuits with DC excitation (L4)
- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations (L4)

UNIT-II (10 Hrs)

DC & AC Machines: Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator –principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single-Phase Transformer - OC and SC tests on transformer -Principle and operation of 3-phase AC machines [Elementary treatment only]

Learning Outcomes: At the end of this unit, students should be able to

- Explain principle and operation of DC Generator & Motor. (L2)
- Perform speed control of DC Motor (L3)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor - DC motor (L2)

UNIT-III (10 Hrs)

Basics of Power Systems: Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary& Secondary distribution systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand working operation of various generating stations (L1)
- Explain the types of Transmission and Distribution systems (L2)

TEXTBOOKS:

1. "Basic Electrical Engineering", D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2010.
2. "Principles of Power System", V.K. Mehta & Rohit Mehta, S. Chand, 2018.

REFERENCE BOOKS:

1. "Fundamentals of Electrical Engineering", L. S. Bobrow, Oxford University Press, 2011.
2. "Electrical and Electronics Technology", E. Hughes, Pearson, 2010.
3. "Generation Distribution and Utilization of Electrical Energy", C.L. Wadhwa, New Age International Publications, 3rd Edition.

Part 'B'- Electronics Engineering

UNIT-I (10 Hrs)

Diodes and Applications: Semiconductor Diode, Diode as a Switch& Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications of Zener Diode, LED, Photo Diode.

Transistor Characteristics: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Biasing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

Learning outcomes: At the end of this unit, students should be able to

- Remember and understand the basic characteristics of semiconductor diode. (L1)
- Understand principle of operation of Zener diode and other special semiconductor diodes (L1)
- Analyze BJT based biasing circuits. (L3)
- Design an amplifier using BJT based on the given specifications. (L4)

UNIT-II (10 Hrs)

Operational Amplifiers and Applications: Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

Learning outcomes: At the end of this unit, students should be able to

- Describe operation of Op-Amp based linear application circuits, converters, amplifiers and non-linear circuits. (L2)
- Analyze Op-Amp based comparator, differentiator and integrator circuits. (L3)

UNIT-III (10 Hrs)

Digital Electronics: Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder. Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters.

Learning outcomes: At the end of this unit, students should be able to

- Explain the functionality of logic gates. (L2)
- Apply basic laws and De Morgan's theorems to simplify Boolean expressions. (L3)
- Analyze standard combinational and sequential circuits. (L4)

TEXTBOOKS:

1. "Electronic Devices & Circuit Theory", R. L. Boylestad & Louis Nashlesky, Pearson Education, 2007.
2. "Op-Amps & Linear ICs", Ramakanth A. Gayakwad, Pearson, 4th Edition, 2017.
3. "Modern Digital Electronics", R. P. Jain, Tata Mcgraw Hill, 3rd Edition, 2003.
4. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2nd Edition, 2012.

REFERENCE BOOKS:

1. "Basic Electronics - Devices, Circuits and IT Fundamentals", Santiram Kal, Prentice Hall of India, 2002.
2. "A Text Book of Electronic Devices and Circuits", R. S. Sedha, S.Chand & Co, 2010.
3. "Introductory Electronic Devices & Circuits - Conventional Flow Version", R. T. Paynter, Pearson Education, 2009.

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A020304			0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To Verify Kirchoff's laws and Superposition theorem
- To learn performance characteristics of DC Machines and 1- Phase Transformer
- To Study the I – V Characteristics of Solar PV Cell
- To analyze the characteristics of Diodes, BJT, MOSFET, UJT
- To design the amplifier circuits from the given specifications.
- Exposed to linear and digital integrated circuits

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Understand Kirchoff's Laws & Superposition theorem.

CO2: Analyze the various characteristics on 1-phase transformer and DC Machines by conducting various tests.

CO3: Analyze I – V Characteristics of PV Cell

CO4: Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.

CO5: Construct and analyze the various diode rectifiers, clippers and clampers and other circuits.

CO-PO MAPPING;

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

PART A: ELECTRICAL ENGINEERING

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Load test on 1-Phase Transformer.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

PART B: ELECTRONICS ENGINEERING

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Full Wave Rectifier with & without filter.
4. Wave Shaping Circuits. (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration.
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting amplifiers using Op-AMPs.
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
9. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs all the required active devices

Note: Minimum of Six Experiments to be performed in each section.

Course Code	MATERIAL SCIENCE AND ENGINEERING LAB		L	T	P	C
21A030304			0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize with the Micro-structures of heat treated and untreated metals.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Identify the ferrous and non – ferrous materials by observing micro structure using Electron microscope

CO2: Identify the Heat-treated steel materials by observing micro structure using Electron microscope

CO3: Identify the Hardness of material before and after heat treatment.

CO4: Determine the hardenability of High Carbon steel.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	-	-	2	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO4	3	3	2	2	2	-	-	-	-	-	-	-	1	1

LIST OF EXERCISES:

1. Preparation and study of the Microstructure of pure metals Cu
2. Preparation and study of the Microstructure of pure metals Al.
3. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
4. Preparation and study of the Micro Structures of Cast Irons.
5. Preparation and study of the Micro Structures of Non-Ferrous alloys.
6. Preparation and study of the Micro structures and hardness of Hardened steels.
7. Preparation and study of the Micro structures and hardness of Normalizing steels.
8. Hardenability of steels by Jominy End Quench Test.
9. Preparation of Composite material by using Hand Layup Method.

Course Code	COMMUNICATIVE ENGLISH LAB (Common to all branches)		L	T	P	C
21A110201			0	0	2	1
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with special emphasis on Listening and Speaking skills.
- To equip students with professional skills & soft skills, Develop communication skills in formal and informal situations
- To help students present themselves confidently during Group Discussions and Oral Presentations

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use creativity in listening to formal and informal conversations.
CO2: Analyze the concepts of active listening and barriers to listening.
CO3: Communicate effectively in everyday life using right oral expressions.
CO4: Acquire the confidence to present themselves effectively during academic and professional presentations.
CO5: Acquire basic knowledge of non-verbal communication and its importance.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	3	-	-	-	-	-

UNIT-I (6 Hrs)

Essentials of Listening: Purpose of Listening, Listening to Conversation (Formal and Informal), Active Listening- an Effective Listening Skill, Barriers to Listening, Listening to Announcements- (railway/ bus stations/ airport /sports announcement/commentaries etc.)

Learning Outcomes: At the end of this unit, students should be able to

- Know the difference between hearing and listening. (L2)
- Understand the purpose of active listening. (L2)
- Follow the announcements through focused listening. (L2)

UNIT-II (6 Hrs)

Listening Comprehension: Academic Listening (Listening to Lectures), Listening to Short Talks and Listening to Presentations, Note Taking Tips

Learning Outcomes: At the end of this unit, students should be able to

- Comprehend different academic lectures. (L3)
- Take notes while listening to short talks and lectures. (L3)
- Improve comprehension skills through listening to short talks and presentations. (L3)

UNIT-III (6 Hrs)

Communicating in everyday life: Asking for and giving information, Offering and responding to offers, Requesting and responding to requests, Congratulating people on their success, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving,

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate expressions to communicate in everyday life. (L3)
- Communicate effectively in different contexts of conversations. (L3)
- Participate in role plays and situational dialogues with an exposure to social and professional contexts. (L3)

UNIT- IV (6 Hrs)

Presentation Skills: Giving Short Talks, Preparing power point presentation, Greeting and Introducing in presentations, Presenting a paper, Participating in group discussions (dos & don'ts)

Learning Outcomes: At the end of this unit, students should be able to

- Prepare a power point presentation effectively. (L3)
- Present a paper in a seminar. (L3)
- Participate in Group Discussions efficiently. (L3)

UNIT-V (6 Hrs)

Non-verbal Communication: Personal Appearance, Gestures, Postures, Facial Expression, Eye Contact, Body Language (Kinesics), Silence, Tips for Improving Non-Verbal Communication

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of body language in communication (L2)
- Improve non-verbal communication skills (L3)
- Understand how body language and non-verbal communication affects the personality of an individual in a social and professional set-up. (L2)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. “A Textbook of English Phonetics for Indian Students”, T. Balasubramanian, Mc Millan India Pvt
2. “English Vocabulary in Use”, Michael McCarthy, Cambridge University Press
3. “Strengthen your English”, Bhaskaran, Horsburgh, Oxford University Press
4. “Practical English Usage”, Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://learnenglish.britishcouncil.org/skills/listening
2. https://agendaweb.org/listening/comprehension-exercises.html
3. https://www.123listening.com/
4. https://www.linguahouse.com/learning-english/skill-4-learners/listening
5. https://www.talkenglish.com/listening/listen.aspx
6. https://ed.ted.co

Course Code	ENVIRONMENTAL SCIENCE		L	T	P	C
21A000001	(Common to CE, ME, EEE, ECE, CSE, CSE-IOT)		2	0	0	0
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo- chemical cycles and ecological pyramids.

CO3: Understand various causes of pollution and solid waste management and related preventive measures.

CO4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5: Cases of population explosion, value education and welfare programmes.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO2	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO3	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO5	-	-	-	-	-	1	2	1	-	-	-	1	-	-

UNIT – I (10 Hrs)

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance, Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems –Forest resources – Use and over–exploitation, deforestation, case studies - Timber extraction – Mining, dams and other effects on forest and tribal people– Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of public awareness (L1)
- Know about the various resources (L1)

UNIT–II (10 Hrs)

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes: At the end of this unit, students should be able to

- Know about various echo systems and their characteristics (L1)
- Know about the biodiversity and its conservation (L1)

UNIT – III (10 Hrs)

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the various sources of pollution. (L1)
- Know about the various sources of solid waste and preventive measures. (L1)

- Know about the different types of disasters and their managerial measures. (L1)

UNIT- IV (10 Hrs)

Social Issues and The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, water shed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the social issues related to environment and their protection acts. (L1)
- Know about the various sources of conservation of natural resources. (L1)
- Know about the wild life protection and forest conservation acts. (L1)

UNIT – V (10 Hrs)

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the population explosion and family welfare programmes. (L1)
- Identify the natural assets and related case studies. (L1)

TEXTBOOKS:

1. "Text book of Environmental Studies for Undergraduate Courses", Erach Bharucha for University Grants Commission, Universities Press.
2. "Environmental Studies", Palani swamy, Pearson education
3. "Environmental Studies", S. Azeem Unnisa, Academic Publishing Company
4. "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", K. Raghavan Nambiar, SCITECH Publications (India), Pvt. Ltd.

REFERENCE BOOKS:

1. "Textbook of Environmental Science", Deeksha Dave and E. Sai Baba Reddy, Cengage Publications.
2. "Text book of Environmental Sciences and Technology", M. Anji Reddy, BS Publication.
3. "Comprehensive Environmental studies", J. P. Sharma, Laxmi publications.
4. "Environmental Sciences and Engineering", J. Glynn Henry and Gary W. Heinke, Prentice Hall of India Private limited
5. "A Text Book of Environmental Studies", G. R. Chatwal, Himalaya Publishing House
6. "Introduction to Environmental Engineering and Science", Gilbert M. Masters and Wendell P. Ela, Prentice Hall of India Private limited.

Course Code	MATHEMATICAL METHODS (Common to all branches)		L	T	P	C
21A110102			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- This course aims at providing use of matrix algebra techniques for practical applications.
- This course aims at providing the student with the knowledge on Various numerical Methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop the use of matrix algebra techniques that is needed by engineers for practical applications.

CO2: Understand and solve the roots of equation using Bisection method, Iterative method, Regula-Falsi method, Newton Raphson method and solve the system of algebraic equations.

CO3: Apply concept of interpolation and derive interpolating polynomial using Newton's forward and backward formulae, Lagrange's formulae, Gauss forward and backward formulae.

CO4: Solving initial value problems to ordinary differential equations.

CO5: Determine the process of finding integral equations using Simson's 1/3, Simson's 3/8 Rule and Trapezoidal rule and fitting a best curve using least squares method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1	-

UNIT- I (10 Hrs)

Matrices: Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their Properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Diagonalization of a matrix.

Learning Outcomes: At the end of this unit, students should be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT - II (10 Hrs)

Solution of Algebraic & Transcendental Equations: Introduction-Bisection Method-Iterative method-Regula-Falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan Method-Gauss Seidal method.

Learning outcomes: At the end of this unit, students should be able to

- Calculate the roots of equation using Bisection method and Iterative method. (L3)
- Calculate the roots of equation using Regula-Falsi method and Newton Raphson method. (L3)
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Seidal method. (L3)

UNIT - III (10 Hrs)

Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of interpolation. (L2)
- Derive interpolating polynomial using Newton's forward and backward formulae. (L3)
- Derive interpolating polynomial using Lagrange's formulae. (L3)
- Derive interpolating polynomial using Gauss forward and backward formulae. (L3)

UNIT - IV (12 Hrs)

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations- Euler's Method - Modified Euler's Method-Runge-Kutta Methods.

Learning Outcomes: At the end of this unit, students should be able to

- Solve initial value problems to ordinary differential equations using Taylor's method. (L3)
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods. (L3)

UNIT - V (12 Hrs)

Numerical Integration & Curve Fitting:

Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Fitting of straight line – second degree curve –Exponential curve –Power curve by the method of least squares.

Learning Outcomes: At the end of this unit, students should be able to

- Fit a best curve using method of least squares. (L3)
- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule. (L3)
- Solve integral equations using Trapezoidal rule. (L3)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna publishers.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India
3. "Introductory Methods of Numerical Analysis", S. S. Sastry, PHI publishers.

REFERENCE BOOKS:

1. "Higher Engineering Mathematics", B. V. Ramana, Mc Graw Hill publishers.
2. "Advanced Engineering Mathematics", Alan Jeffrey, Elsevier Publishers
3. "A Text Book of Engineering Mathematics Vol – I", T.K.V. Iyengar, B. Krishna Gandhi, S. Chand & Company.

Course Code	ENGINEERING THERMODYNAMICS		L	T	P	C
21A030305			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Explain relationships between properties of matter and basic laws of thermodynamics.
- Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand thermodynamic systems, properties and their importance in solving engineering problems.
CO2: Make energy balance for closed systems and open systems.
CO3: Apply second law of thermodynamics in design of heat engine, refrigerator and heat pump.
CO4: Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process.
CO5: Apply properties of steam to design steam by systems, explain the cycles on which internal combustion engines work.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	2	1
CO2	3	2	2	2	3	-	-	-	-	-	-	-	2	2
CO3	2	2	2	2	3	-	-	-	-	-	-	-	2	2
CO4	3	2	3	3	2	-	-	-	-	-	-	-	2	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	2	2

UNIT-I (12 Hrs)

Basic Concepts: Systems -Types, Surrounding, Macroscopic and Microscopic approaches, Concept of Continuum, properties-types, Thermodynamic Equilibrium, State, Path, Process, cycle, Quasi–static Process, energy in storage, energy in transit- Work and Heat, Point and Path functions, various forms of Work, temperature and Zeroth Law of Thermodynamics, temperature scales, Const. volume gas thermometer.

Learning Outcomes: At the end of this unit, students should be able to

- Understand thermodynamic systems, properties and their importance in solving engineering problems(L3)
- Make energy balance for closed systems and open system(L2)
- Solve simple thermodynamic problems(L4)

UNIT-II (12 Hrs)

First Law of Thermodynamics: First law for a closed system undergoing a cycle and for a change of state, enthalpy, specific heats. Steady flow energy equation and its application to engineering equipment, Perpetual Motion machine of first kind. (PMM-I). Limitations of First Law of Thermodynamics. The directional constraints on natural processes; Concept of reversibility, causes of Irreversibility.

Learning Outcomes: At the end of this unit, students should be able to

- Familiarize concepts of heat, work, energy governing rules for conversion of one form to other(L3)
- Understand the relationships between properties of matter and basic law of thermodynamics(L2)

UNIT-III (14 Hrs)

Second Law of Thermodynamics: Thermal reservoirs, Heat engines and Refrigerators and heat pumps, Kelvin- Planck and Clausius statements, and their equivalence, PMM-II, Carnot cycle, Carnot theorems, and corollaries. Absolute thermodynamic scale of temperature.

Entropy: Inequality of Clasius, Entropy change for various processes, entropy principle, Available and unavailable energies, Available energies for closed and open system. Maxwell relations; Tds Equations.

Learning Outcomes: At the end of this unit, students should be able to

- Apply second law thermodynamics in design heat engine, refrigerator and heat pump(L3)
- Explain the efficiency of thermodynamic systems(L2)
- Apply the entropy concepts to estimate the performance of the systems(L1)

UNIT-IV (12 Hrs)

Properties of pure substances:

Definition of Pure Substance, P-V, P-T, T-S, and h-s diagrams of a Pure substance, Triple point, Critical point, P-V-T surfaces, Dryness Fraction, Steam Tables, Mollier chart, Analysis of various thermodynamic processes. Measurement of steam Quality: throttling and separating and throttling calorimeter.

Learning Outcomes: At the end of this unit, students should be able to

- Apply properties of the steam to design steam systems(L3)
- Evaluate the dryness fraction and performance of steam systems(L2)
- Examine the steam systems using conservation equation(L1)

UNIT-V (16 Hrs)

Perfect Gases and Gas mixtures – Equation of State, Ideal gas equation, Universal and characteristic Gas constants, Mixtures of perfect Gases – Mole Fraction, Mass fraction, Dalton's Law of partial pressure, Avogadro's Laws of additive volumes.

Power cycles: Otto, Diesel, Dual Combustion cycles and comparison of Otto, diesel, Dual Cycles, Brayton cycle on Air standard basis. Simple Rankine cycle.

Learning Outcomes*:* At the end of this unit, students should be able to

- Explain the cycles on which internal combustion engine works(L3)
- Explain the importance of compression ratio(L2)
- Use the ideal gas law to compute gas densities and molar masses(L2)
- State Dalton's law of partial pressures and use it in calculations involving gaseous mixtures. (L1)

TEXTBOOKS:

1. "Engineering Thermodynamics", PK Nag, Tata McGraw Hill Publishing Company Ltd., 6th Edition.
2. "Fundamentals of Thermodynamics", Richard E Sonntag, Claus Borgnakke, Gordon J. Van Wylen, 8th Edition.

REFERENCE BOOKS:

1. "Thermodynamics-An Engineering Approach", Yunus A. Cengel & Michael A. Boles Tata McGraw Hill Education, 8th Edition.
2. "Fundamentals of Engineering Thermodynamics", Micheal J Moran and Howard N Shapiro, wiley, 8th Edition.
3. "Engineering Thermodynamics", Y. V. C. Rao, University Press.

Course Code	MECHANICS OF SOLIDS		L	T	P	C
21A030306			3	0	0	3
Pre-requisite	Engineering Mechanics	Semester	III			

COURSE OBJECTIVES:

- Introduce the concepts of different stresses, strains and their relationships.
- Discuss the principal stresses and components of stress on different planes under different loads.
- Explain maximum shear force and bending moment of different beams under different loading conditions.
- Demonstrate bending stress and shear stress distribution of various cross section of beams and to predict the maximum slope deflection of beams.
- Impart strain energy due to axial, bending, and torsion loading,
- Focus on the stresses and deformations of the springs.
- Discuss the torsional stresses developed in the shafts
- Demonstrate hoop stress and longitudinal stresses in pressure vessels

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Calculate stresses, strains and deformations of basic geometries under axial loading and thermal effects, Construct the Mohr's circle for calculating principal stresses and analyze principal stresses in biaxial state of loading.

CO2: Draw Shear Force and Bending Moment Diagrams for different types of beams and loading conditions.

CO3: Compute bending and shear stresses in beams under different loading conditions.

CO4: Calculate deflections of beams and stress in spring under different boundary and loading conditions.

CO5: Calculate shear strength of shafts subjected to torsional loading and determine stresses and strains induced in the thin and thick cylinders subjected to fluid pressure.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	-	2	2
CO2	3	2	1	1	-	-	-	-	-	-	-	-	2	2
CO3	3	2	1	1	-	-	-	-	-	-	-	-	2	3
CO4	3	2	1	1	-	-	-	-	-	-	-	-	2	3
CO5	3	3	1	1	-	-	-	-	-	-	-	-	3	3

UNIT-I (12 Hrs)

Simple stresses and Strains: Mechanical properties of materials, Types of stresses and strains, stress-strain diagram of ductile and brittle materials, poison's ratio, elastic constants and their relation, bars of uniform and varying sections, composite bars, thermal stresses, factor of safety. Strain energy: Introduction, strain energy in gradual, sudden and impact loading.

Principal stresses and strains: Biaxial state of stress with and without shear - Mohr's Circle and analytical methods.

Learning Outcomes: At the end of this unit, students should be able to

- Determine stresses and deformations due to axial loads in simple members. (L3)
- Analyse stresses compound bars due to temperature raise. (L4)
- Correlate the elastic constants of materials. (L3)
- Construct the Mohr's circle for calculating principal stresses. (L3)
- Analyse principal stresses in biaxial state of loading. (L4)

UNIT-II (12 Hrs)

Shear force and Bending moment in Beams: Introduction, Types of beams, shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to point, uniformly distributed and uniformly varying loads, relation between Shear force and bending moment.

Learning Outcomes: At the end of this unit, students should be able to

- Determine the shear force and bending moment values in beams subjected to different types of loadings. (L3)
- Draw shear force and bending moment diagrams in beams subject to bending loading. (L3)
- Determine the point of contraflexure in overhanging beams. (L3)
- Evaluate the maximum shear force and bending moment and their location in beams. (L4)

UNIT-III (12 Hrs)

Stresses in Beams: Flexural Stresses: Theory of simple bending, derivation of bending equation, section modulus of different cross sections.

Shear Stresses: Shear stress equation, shear stress distribution across various beam sections.

Learning Outcomes: At the end of this unit, students should be able to

- Determine bending stresses in beams under different loading. (L4)
- Demonstrate the shear stress and bending moment distribution in different cross sections of beams. (L4)

UNIT-IV (12 Hrs)

Deflection of Beams: Bending into a circular arc – slope, deflection and radius of curvature, differential equation for the elastic line of a beam, double integration and Macaulay's methods, mohr's moment area method, slope and deflection for cantilever and simply supported beams subjected to point, uniformly distributed and uniformly varying loads.

Torsion: Torsion of circular shafts, transmission of power by circular shafts, Shafts in series and parallel.

Learning Outcomes: At the end of this unit, students should be able to

- Compute the slope and deflection in beam under different loading. (L3)
- Distinguish various approaches for calculating slope and deflection. (L4)
- Determine angle of twist in shafts. (L4)
- Analyze circular shafts subjected to twisting couple. (L4)
- Determine stresses in shafts subjected to combined loads. (L4)

UNIT-V (15 Hrs)

Columns and Struts : Introduction – Types of columns – Short, medium and long columns Axially loaded compression members – Crushing load – Euler's theorem for long columns – assumptions – derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – Slenderness ratio – Euler's critical stress –Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

Pressure Vessels: Thin seamless cylindrical shells, longitudinal and circumferential stresses, volumetric strain in thin cylinders, thin spherical shells. Lame's equation, thick cylinders subjected to inside & outside pressures, compound cylinders.

Learning Outcomes: At the end of this unit, students should be able to

- Determine the buckling load in compressive members. (L3)
- Applying the concepts of elastic stability of columns. (L3)
- Determine hoop and longitudinal stresses in thin and thick cylinders. (L3)
- Determine hoop and longitudinal strains in thin & thick cylinders. (L3)
- Determine stresses and strains in thin spherical shells. (L3)
- Calculate volumetric strain. (L3)

TEXTBOOKS:

1. "A text book of strength of materials", Dr. R K Bansal, Lakshmi Publications, 3rd Edition.
2. "Strength of materials", S.S. Rattan, Tata Mc Graw Hill Publications, 2nd Edition.

REFERENCE BOOKS:

1. "Mechanics of Materials", Beer and Johnson, Tata McGraw Hill publications, 5th Edition.
2. "Engineering Mechanics of Solids", Popov and Egor P., Prentice Hall India.
3. "Mechanics of materials", James M. Gere and Barry Goodier, CENGAGE Learning Custom Publishing, 8th Edition.

Course Code	FLUID MECHANICS AND HYDRAULIC MACHINERY		L	T	P	C
21A030401			3	0	0	3
Pre-requisite	Engineering Mechanics	Semester	III			

COURSE OBJECTIVES:

- To introduce the fluid properties, basic laws, principles of conservation of mass, momentum and energy and their application in the study of fluid flow.
- To introduce the principles of hydraulic turbines and pumps, along with their performance characteristics.
- To understand different components of a hydroelectric power plant and understand the basic concepts of power production using energy of water

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Define the properties of fluids and classify the fluids.

CO2: Apply conservation laws to fluid flow problems in engineering applications.

CO3: Understand various components of Hydro Electric power plant and importance of impact of jets.

CO4: Illustrate the working and performance of Hydraulic machines.

CO5: Understand the working of power absorbing devices like pumps and able to analyze their performance characteristics.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	-	-	-	-	-	-	1	2	2
CO2	3	3	3	3	1	-	-	-	-	-	-	1	2	2
CO3	3	3	3	2	1	-	-	-	-	-	-	1	2	2
CO4	3	2	2	2	1	-	-	-	-	-	-	1	2	-
CO5	3	3	3	3	1	-	-	-	-	-	-	1	2	2

UNIT-I (15 Hrs)

Fluid Statics: Dimensions and units: physical properties of fluids specific gravity, viscosity, surface tension- vapour pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure – measurement of pressure- Piezometer, U-tube and differential manometers.

Fluid Kinematics: stream line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows-Equation of continuity for one dimensional flow.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the fundamental fluid properties and their engineering significance. (L2)

- Differentiate between different pressures and study the methods of fluid pressure measurement. (L3)
- Analyze the problems on different fluid surfaces. (L4)

<u>UNIT-II</u> (15 Hrs)

Fluid Dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

Conduit Flow: Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pitot tube, venturimeter and orifice meter.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand fundamental equations, used in the analysis of fluid flow problems like continuity, energy and momentum equations. (L2)
- Understand the different types of pipe flow and the conditions governing them. (L2)
- Understand the working of the different devices used for measurement of fluid flow under different conditions. (L2)

<u>UNIT-III</u> (14 Hrs)

Hydroelectric Power Stations: Elements of hydroelectric power station-types. Concept of pumped storage plants- storage requirements.

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand an overview of different aspects of hydro power generation. (L2)
- Understand the different types of power plant and estimation of power that can be generated from these plants (L2)
- Draw the velocity triangles and analyse the same to arrive at the required quantities. (L4)

<u>UNIT-IV</u> (12 Hrs)

Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of Hydraulic Turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the features and working of different hydraulic turbines and their use. (L2)

- Analyze various quantities like work done and efficiency of Hydraulic Turbines. (L4)
- Analyze the performance of the various hydraulic turbines. (L4)

UNIT-V (12 Hrs)

Centrifugal Pumps: Classification, working, work done – manometric head- losses and efficiencies specific speed- pumps in series and parallel performance - characteristic curves, NPSH.

Reciprocating Pumps: Working, Discharge, slip, indicator diagrams.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand the various types and purposes of hydraulic machines (pumps). (L2)
- Understand different types of pumps, their working and applications. (L2)
- Analyze the performance of the various hydraulic Pumps. (L4)

TEXTBOOKS:

1. "Fluid mechanics and Hydraulic machinery", Modi and Seth, Standard Book house.
2. "A Text of Fluid Mechanics and Hydraulic Machines", Dr. R. K. Bansal – Laxmi Publications (P) Ltd., New Delhi.

REFERENCE BOOKS:

1. "Fluid Mechanics and Machinery", D. Rama Durgaiah, New Age International.
2. "Fluid mechanics and fluid machines", Rajput, S. Chand & Co.

Course Code	MANUFACTURING PROCESSES		L	T	P	C
21A030402			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Working principle of different metal casting processes and gating system.
- Nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Principles of forging, tools and dies, working of forging processes.
- Classification of the welding processes, working of different types of welding processes and welding defects
- Classification, applications and manufacturing methods of plastics, ceramics and powder metallurgy.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand various casting process involved in the conversion of raw materials to useful products, gating system features and designing of Risers.

CO2: Identify and analyze various welding and metal cutting operations.

CO3: Apply the knowledge of metal working process in sheet metal forming Processes, drawing and rolling and analyzing the process variables.

CO4: Understand the primary forming processes like forging, extrusion, equipment used and process variables.

CO5: Identify various plastic parts manufacturing techniques and their methods.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	3	-	-	-	-	-	-	-	-	1	2	2
CO2	-	3	3	-	3	3	-	-	-	-	-	1	3	3
CO3	-	3	3	-	3	3	-	-	-	-	-	1	3	3
CO4	-	3	3	-	-	3	-	-	-	-	-	1	3	3
CO5	-	3	3	-	-	-	-	-	-	-	-	1	3	3

UNIT-I (12 Hrs)

Introduction: Importance and selection of manufacturing processes.

Casting Processes: Introduction to casting process, process steps; pattern: types, materials and allowance; Cores: Types of cores, core prints, principles and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

Learning Outcomes: At the end of this unit, students should be able to

- Selection of suitable manufacturing process for a given product (L3)
- Understand the steps involved in metal casting, pattern making (L2)
- Apply the knowledge of designing gating systems, risers(L3)
- Compare the working of various metal casting processes (L4)
- Identify the various casting defects (L3)

<u>UNIT-II</u> (14 Hrs)

Metal Joining Processes: Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding. applications, advantages and disadvantages of the above processes, other fabrication processes. Heat affected zones in welding; Welding defects: causes and remedies, soldering and brazing: Types and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the working of various welding processes (L2)
- Compare V-I characteristics of different welding processes (L4)
- Summarize the applications, advantages of various welding processes (L2)
- Identify the defects in welding (L3)

<u>UNIT-III</u> (12 Hrs)

Metal Forming: Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; Rolling: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements;

Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Compare cold working and hot working processes (L4)
- Explain the working of rolling mills (L2)
- Evaluate the forces and power in rolling and extrusion processes (L5)
- Summarize the working of various extrusion processes (L2)

<u>UNIT-IV</u> (12 Hrs)

Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the principles of forging, tools and dies (L3)
- Summarize the various operations of Sheet metal forming (L2)

UNIT-V (12 Hrs)

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding and blow molding

Ceramics: Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

Powder Metallurgy: Principle, manufacture of powders, steps involved.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the methods of manufacturing plastics parts (L2)
- Explain the steps in making ceramics parts (L2)
- Explain the steps in manufacturing of powder metallurgy parts (L2)
- Demonstrate the application of plastic, ceramics and power metallurgy (L2)

TEXTBOOKS:

1. "Manufacturing Technology – Volume I", Rao. P. N, McGraw-Hill Education, 5th Edition, 2018.
2. "Manufacturing Engineering and Technology", Kalpakjain S and Schmid S.R, Pearson, 7th Edition, 2018.

REFERENCE BOOKS:

1. "Fundamentals of Modern Manufacturing: Materials, Processes and Systems", Mikell P. Groover, John Wiley and Sons Inc, 4th Edition, 2010.
2. "A Text book of Production Technology", Sharma P.C., S Chand Publishing, 2014.

Course Code	MECHANICS OF SOLIDS LAB		L	T	P	C
21A030307			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To find the properties of different materials by practical experimentation

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand the stress-strain behaviour of different materials.
CO2: Identify the difference between compression and tension testing.
CO3: Evaluate the hardness of different materials.
CO4: Correlate the elastic constants of the materials.
CO5: Explain the relation between elastic constants and hardness of materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO2	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	2	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	2	-

LIST OF EXPERIMENTS:

1. Study the stress – strain relations of (a) Mild Steel b) Cast iron and (c) Tor Steel By conducting tension/compression test on U.T.M.
2. Study the stress – strain relation of (a) Copper and (b) Aluminium (c) other materials By conducting tension /compression test.
3. Find the compressive and shear strength of wood and shear strength of GI sheet By conducting relevant tests.
4. Find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminium (d) Copper.
5. Determine the Modulus of rigidity (a) Solid shaft (b) Hollow shaft made of steel and aluminium.
6. Find the spring index and modulus of rigidity of the material of a spring by conducting compression and tensile tests.
7. Determine the Young's modulus of the material by conducting deflection test on a simply supported, propped cantilever and continuous beams.
8. Find impact strength of a given material by conducting a) Charpy test and b) Izod test
9. Determine buckling load in a compressive member made with steel and aluminium.
10. Determine the deflection in leaf spring with a single leaf and multiple

Course Code	FLUID MECHANICS AND HYDRAULIC MACHINERY LAB		L	T	P	C
21A030403			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVE:

- The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.
- To provide practical knowledge in verification of principles of fluid flow.
- To impart knowledge in measuring pressure, discharge and velocity of fluid flow.
- To gain knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Analyze a variety of practical fluid-flow devices like venture meter & orifice meter.
CO2: Analyze the performance of different types of turbines like impulse and reaction.
CO3: Analyze the performance of different types of pumps like rotodynamic and positive displacement pumps.
CO4: Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design
CO5: Analyze the different types of loses in fluid flow problems

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO2	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-	2	-
CO5	-	-	-	3	-	-	-	-	3	3	-	-	2	-

LIST OF EXPERIMENTS:

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Calibration of contracted Rectangular Notch
4. Calibration of contracted Triangular Notch.
5. Verification of Bernoulli's equation.
6. Determination of head loss due to friction and friction factor
7. Performance test on pelton wheel turbine with constant head
8. Performance test on pelton wheel turbine with constant speed
9. Performance test on Francis turbine with constant head

10. Performance test on Francis turbine with constant speed.
11. Efficiency test on Multi stage centrifugal pump.
12. Performance test on Reciprocating pump.
13. Impact of jet on vanes.

Course Code	MANUFACTURING PROCESSES LAB		L	T	P	C
21A030404			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To gain the knowledge of making of patterns and calculation of its allowances.
- To gain the knowledge of prepare a mould cavity and casting.
- To gain the knowledge of joining of metals by welding process.
- To gain the knowledge of making hallow parts like bottles by the blow moulding machine.
- To gain the knowledge of making plastic components by the injection moulding machine.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand the making of patterns and calculation of its allowances.
CO2: Prepare a mould cavity and casting.
CO3: Understand the joining of metals by welding process, and its heat affected zone on weldments.
CO4: Understand the moulding sand properties with the help of permeability meter, universal sand strength machine.
CO5: Understand the making of hallow parts like bottles by the blow moulding machine. Understand the plastic components by the injection moulding machine.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3	-	-	-	-	3	1	-	1	2	-
CO2	2	2	1	3	2	-	-	-	3	1	-	1	2	-
CO3	2	2	1	1	2	-	-	-	3	-	-	1	2	-
CO4	2	2	1	1	2	-	-	-	3	-	-	1	2	-
CO5	2	2	1	1	1	-	-	-	3	-	-	1	2	-

I. METAL CASTING:

1. Gating Design and pouring time and solidification time calculations.
2. Sand Properties Testing – Exercise for Strength and Permeability.
3. Moulding, Melting and Casting for ferrous/ nonferrous materials.

II. WELDING:

1. TIG Welding.
2. MIG Welding.
3. Friction stir welding
    - Any other Special Welding Processes

III. MECHANICAL PRESS WORKING:

1. Press Tool: Blanking and Piercing operation with Simple, Compound and Combination dies.
2. Closed die forging, Deep Drawing and Extrusion operations.

IV. PROCESSING OF PLASTICS:

1. Injection Moulding.
2. Blow Moulding.

Course Code	SOLID MODELING		L	T	P	C
21A030701			1	0	2	2
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- The course will help students and professionals alike to learn the implementation of solid modelling and get hands-on experience with the real-world projects.
- This course is structured in a pedagogical sequence to cover the topics of part design, assembly, drafting, wireframe & surface, and Generative Sheet metal Design workbenches of CATIA V5.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Create components using sketch-based, dress-up, and hole features**.**

CO2: Assembly design approach to assemble the components.

CO3: Generate the drawing views of the components and assembly.

CO4: Create Sheetmetal components using the tools available in the Generative Sheet metal.

CO5: Generate various mechanisms and simulate them using the tools available in the DMU Kinematics Workbench.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	-	-	-	3	2	-	-	2	2
CO2	-	-	-	-	3	-	-	-	3	2	-	-	2	2
CO3	-	-	-	-	3	-	-	-	3	2	-	-	2	2
CO4	-	-	-	-	3	-	-	-	3	2	-	-	2	2
CO5	-	-	-	-	3	-	-	-	3	2	-	-	2	2

TOPICS TO BE COVERED:

1. Introduction to CATIA V5
2. Drawing sketches in the sketcher workbench
3. Constraining sketches and creating base features
4. Reference elements and sketch-based features
5. Creating dress-up and hole features
6. Editing features
7. Transformation features and advanced modeling tools
8. Working with the wireframe and surface design work bench
9. Editing and modifying surfaces
10. Assembly modeling
11. Working with drafting work bench

REFERENCE BOOKS:

1. "Catia V5R21 for engineers and designers", Sham Tickoo and Gaganjeet Singh sethi.
2. "CATIA V5 Tutorials Mechanism Design &Animation", Nader G. Zamani Jonathan M. Weaver

Course Code	CONSTITUTION OF INDIA		L	T	P	C
21A000002	(Common to all branches)		2	0	0	0
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Understand historical background of the constitution making and its importance for building a democratic India.
CO2: Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.
CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India.
CO4: Analyze the decentralization of power between central, state and local self-government
CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO2	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO3	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO4	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO5	-	-	-	-	-	3	-	2	1	-	-	1	-	-

UNIT-I (10 Hrs)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution-Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Indian constitution (L1)
- Apply the knowledge on directive principle of state policy (L3)
- Analyze the History and features of Indian constitution (L4)
- Learn about Preamble, Fundamental Rights and Duties (L1)

UNIT-II (10 Hrs)

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of Indian government (L1)
- Differentiate between the state and central government (L4)
- Explain the role of President and Prime Minister (L2)
- Know the Structure of supreme court and High court (L1)

UNIT-III (10 Hrs)

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of state government (L1)
- Analyze the role of Governor and Chief Minister (L4)
- Explain the role of State Secretariat (L2)
- Differentiate between structure and functions of state secretariat (L4)

UNIT-IV (10 Hrs)

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning Outcomes: At the end of this unit, students should be able to

- Understand the local Administration (L1)
- Compare and contrast district administration's role and importance (L4)
- Analyze the role of Mayor and elected representatives of Municipalities (L4)
- Learn about the role of Zilla Parishath block level organization (L1)

UNIT-V (10 Hrs)

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Learning Outcomes: At the end of this unit, students should be able to

- Know the role of Election Commission (L1)

- Contrast and compare the role of Chief Election commissioner and Commissionerate (L4)
- Analyze the role of state election commission (L4)
- Evaluate various commissions viz SC/ST/OBC and women (L6)

TEXTBOOKS:

1. "Introduction to the Constitution of India", Durga Das Basu, Prentice Hall of India Pvt. Ltd. New Delhi
2. "Indian Constitution", Subash Kashyap, National Book Trust

REFERENCE BOOKS:

1. "Dynamics of Indian Government & Politics", J.A. Siwach,
2. "Constitutional Law of India", H.M.Sreevai, 4th Edition in 3 volumes (Universal Law Publication)
3. "Indian Government and Politics", J.C. Johari, Hans India

Course Code	OPERATIONS RESEARCH		L	T	P	C
21A030101			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To impart the basic concepts of modelling, formulate and solve linear programming, transportation and queuing theory problems.
- Explain scheduling and sequencing of production runs and develops proper replacement policies.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Formulate practical problems given in words into a mathematical model and solve optimization problems.
CO2: Solve the problems of transportation from origins to destinations with minimum time and cost.
CO3: Solve simple games and production scheduling and develop inventory policies.
CO4: Reducing the waiting time of various queuing models
CO5: Apply the concept of replacement model and solve the problems using dynamic programming technique.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	-	-	2	-	2	2
CO2	3	3	3	3	-	2	-	-	-	-	2	1	2	2
CO3	3	3	3	3	-	2	-	-	-	-	2	-	2	2
CO4	3	3	3	3	-	2	-	1	-	-	2	1	2	2
CO5	3	3	3	3	-	2	-	-	-	-	2	-	2	2

UNIT-I (16 Hrs)

Introduction to Operations Research (OR): OR definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models.

Linear Programming (LP): Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two–Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions; Concept of dual theorem

Learning Outcomes: At the end of this unit, students should be able to

- Formulate practical problems given in words into a mathematical model. (L6)
- Quantify or models to solve optimization problems. (L4)
- Formulate linear programming problems and appreciate their limitations. (L6)

UNIT-II (14 Hrs)

Transportation and Assignment Problems: Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution –North West Corner Rule, Least Cost

Method, Vogel's Approximation Method; Optimality Method – Modified Distribution, Assignment Problem – Formulation, Hungarian Method for Solving Assignment Problems, Travelling salesman problem.

Learning Outcomes: At the end of this unit, students should be able to

- Model linear programming problems like the transportation. (L6)
- Solve the problems of transportation from origins to destinations with minimum time and cost. (L3)

UNIT-III (12 Hrs)

Game theory: Optimal solution of two person zero sum games, the max min and min max principle. Games without saddle points, mixed strategies. Reduction by principles of dominance, arithmetic, algebraic method and graphical method.

Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

Learning Outcomes: At the end of this unit, students should be able to

- Identify strategic situations and represent them as games. (L4)
- Solve simple games using various techniques. (L3)
- Solve problems of production scheduling and develop inventory policies. (L3)

UNIT-IV (10 Hrs)

Queuing Theory: Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue.

Learning Outcomes: At the end of this unit, students should be able to

- Model a dynamic system as a queuing model to compute performance measures. (L6)
- Apply optimality conditions for single- and multiple-variable constrained and unconstrained nonlinear optimization problems. (L3)

UNIT-V (12 Hrs)

Replacement and Maintenance Analysis: Introduction – Types of Maintenance, Make or buy decision. Types of Replacement Problems, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Dynamic Programming (DP): Introduction –Bellman's Principle of Optimality – Applications of Dynamic Programming – Capital Budgeting Problem – Shortest Path Problem – Solution of Linear Programming Problem by DP.

Learning Outcomes: At the end of this unit, students should be able to

- Solve problems using dynamic programming. (L3)
- Apply the concept of replacement model. (L3)

TEXTBOOKS:

1. "Operations Research: Theory, Methods and Applications", Sharma S.D., 15th Edition.
2. "Operations Research", Taha H.A., Prentice Hall of India, New Delhi, 9th Edition, 2010

REFERENCE BOOKS:

1. "Introduction to Operations Research", Hiller F.S., and Liberman G.J., Tata McGraw Hill, 2010.
2. "Operations Research", Prem kumar Gupta and Hira, S Chand Company Ltd., New Delhi, 3rd Edition, 2003.
3. "Operations Research", Pannerselvam R., Pentice Hall of India, New Delhi, 2nd Edition, 2006.
4. "Resource Management Techniques: Operations Research", Sundaresan. V and Ganapathy Subramanian. K.S, A.R Publications, 2015.
5. Operations Research: Theory and Applications", Sharma J.K., Laxmi publications.

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all branches)		L	T	P	C
21A110203			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To know the various types of Market Structures & pricing methods and its strategies.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Analyse the consumer behaviour with regard to their product or services and measure demand of a particular product or services by applying various methods in given situation

CO2: Determine Break Even Point (BEP) of an enterprise Assess the cost behaviour, costs useful for managerial decision making

CO3: Determine the price of a product or services in given market condition

CO4: Analyze the financial position by using different types of ratios and interpret the financial accounting

CO5: Evaluate the investment proposals under payback period, ARR, IRR, NPV & PI methods

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT- I (11 Hrs)

Introduction to Managerial Economics and Demand Analysis: Managerial Economics– Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand- Demand Forecasting- Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Learning Outcomes: At the end of this unit, students should be able to

- Know the nature and scope of Managerial Economics and its importance. (L1)
- Understand the concept of demand and its determinants. (L2)
- Analyse the elasticity and degree of elasticity. (L4)
- Evaluate demand forecasting methods. (L5)
- Design the process of demand estimation for different types of demand. (L6)

UNIT- II (10 Hrs)

Theory of Production and Cost Analysis:

Production Function – Short-run and Long-run Production Function -Isoquants and Iso costs, MRTS –Least cost combination of Inputs, Cobb-Douglas Production Function - Laws of Returns – Internal and External Economies of scale – **Cost & Break-Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA)–Determination of Break-Even Point (Simple Problems)-Managerial significance of Break-Even Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, Input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)
- Develop Profit appropriation for different levels of business activity. (L6)

UNIT- III (11 Hrs)

Introduction to Markets and New Economic Environment:

Market structures Types of Markets-Perfect and Imperfect Competition- Features of Perfect Competition– Monopoly -Monopolistic Competition –Oligopoly-Price-Output Determination-Pricing Methods and Strategies- Forms of Business Organizations - Sole Proprietorship - Partnership – Joint Stock Companies-Public Sector Enterprises -. New economic Environment - **Economic Liberalization – Privatization – Globalization.**

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know the production function, input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)

UNIT- IV (10 Hrs)

Capital and Capital Budgeting: Concept of Capital-Significance-Types of Capital-Components of Working Capital - Sources of Short-term and Long-term Capital -Estimating Working capital requirements-**Capital Budgeting**–Features of Capital Budgeting Proposals –

Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept of Capital Budgeting and its importance in business (L1)
- Contrast and compare different investment appraisal methods. (L4)
- Analyse the process of selection of investment alternative using different appraisal methods. (L4)
- Evaluate methods of Capital budgeting techniques. (L5)
- Design different investment appraisals and make wise investments. (L6)

UNIT–V (10 Hours)

Introduction to Financial Accounting and Analysis: Financial Accounting – Concept – Emerging need and Importance - Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet (with simple adjustments). ***Financial Analysis*** - Ratios- Liquidity, Leverage, Profitability and Activity Ratios (Simple Problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept and convention and significance of accounting. (L1)
- Apply the fundamental knowledge of accounting while posting the Journal entries. (L3)
- Analyze the process and preparation of Financial Accounts and Financial Ratios. (L4)
- Evaluate the Financial performance of an enterprise by using financial statements. (L5)

TEXTBOOKS:

1. “Managerial Economics”, Varshney & Maheswari, S. Chand, 2013.
2. “Managerial Economics and Financial Analysis”, Aryasri, MGH, 4th Edition, 2019

REFERENCE BOOKS:

1. “Managerial economics”, Ahuja HL, S. Chand, 3rd Edition, 2013.
2. “Managerial Economics and Financial Analysis”, S. A. Siddiqui and A. S. Siddiqui, New Age International, 2013.
3. “Principles of Business Economics”, Joseph G. Nellis and David Parker, Pearson, 2nd Edition, New Delhi.
4. “Managerial Economics in a Global Economy”, Dominick Salvatore, Cengage Learning, 2013.

Course Code	APPLIED THERMODYNAMICS		L	T	P	C
21A030405			3	0	0	3
Pre-requisite	Engineering Thermodynamics	Semester	IV			

COURSE OBJECTIVES:

- To introduce the principles of operation of I.C engines and compressors along with the performance characteristics.
- To familiarize with various thermodynamic cycles of Refrigeration and air conditioning processes.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the working of 4-s and 2-s engines, calculate thermal efficiency in I.C. engines and draw heat balance sheet.

CO2: Understand the working of reciprocating compressors and advantages of multistage compression.

CO3: Describe the working of centrifugal and axial flow compressors and evaluate the performance.

CO4: Analyze various refrigeration cycles and evaluate their performance under various operating conditions.

CO5: Estimate the psychometric properties and analyze the psychometric processes applied to air conditioning.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	-	2	2
CO2	2	2	3	2	2	-	-	-	-	-	-	-	2	2
CO3	3	2	3	2	3	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	3	-	-	-	-	-	-	-	2	2
CO5	2	3	3	2	3	-	-	-	-	-	-	-	2	2

UNIT-I (14 Hrs)

Heat Engines: Engine Components, Basic Engine Nomenclature, Classification, Four Stroke and Two Stroke Engines, Valve and Port Timing Diagrams, S.I and C.I engines, Comparison of SI and CI Engines.

Testing and Performance of I.C Engines: Indicated power, brake power, frictional power, Indicated and brake thermal efficiencies, Performance test, Heat balance sheet.

Learning Outcomes: At the end of this unit, students should be able to

- To apply the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon(L3)
- To identify and formulate power production based on the fundamentals laws of thermal engineering(L2)

- To instil upon to envisage appropriate experiments related to heat engines (L4)

UNIT-II (12 Hrs)

Compressors: Classification - Reciprocating and Rotary, Positive displacement and dynamic machines.

Reciprocating Compressors: Principle of operation, Single stage of Compression - Work required, Isothermal efficiency, volumetric efficiency and effect of clearance, Free Air Delivered, displacement. Multi stage compression - under cooling, saving of work, minimum work condition for Multistage stage compression. Root blower, soot blower, vane type blower.

Learning Outcomes: At the end of this unit, students should be able to

- To understand theory and performance Calculation of Positive displacement compressor(L3)
- Describe construction, working of various types of reciprocating and rotary Compressors with performance calculations of positive displacement compressors(L2)
- Understand absolute and gage pressure, and absolute temperature(L2)

UNIT-III (12 Hrs)

Centrifugal Compressors: Mechanical details and principle of operation – velocity and pressure variation. Ideal energy transfer, blade shapes and velocity triangles, analysis of flow through the compressors, slip factor, performance parameters - power input factor, pressure coefficient, compressor efficiency. Surging and choking.

Axial Flow Compressors: Mechanical details and principle of operation – stage velocity triangles, work input to the compressor, work done factor, compressor stage efficiency, degree of reaction, comparison of centrifugal and axial compressors. Surging and stalling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of compressed media in production and research(L4)
- Distinguishing compressor types and their application area(L3)
- Principles of rotary compressors: single and multiple vanes, Roots, screw and scroll(L3)

UNIT-IV (14 Hrs)

Introduction: Introduction to Refrigeration, Bell Coleman cycle. **Refrigerants:** Desirable properties.

Vapor Compression Refrigeration: Working principle and essential components of the plant, actual cycle, effect of sub-cooling, super-heating, effect of evaporator and condenser pressures on system performance – use of p-h charts.

Vapor Absorption System: Description and working of NH_3 – water system, Li Br –water System.

Learning Outcomes: At the end of this unit, students should be able to

- Necessity of Refrigeration and Air conditioning in the present scenario (L4)

- Methods of refrigeration and their working principles (L3)
- Most commonly used refrigeration system in food preservation(L2)
- Learning the fundamental principles and different methods of refrigeration and air conditioning(L2)

UNIT-V (12 Hrs)

Psychrometry: Psychometric Properties, Sensible heating, sensible cooling, humidification and de-humidification, cooling and dehumidification, cooling with adiabatic humidification, heating and humidification, adiabatic mixing of two air streams.

Air-Conditioning systems: summer air conditioning, winter air conditioning.

Learning Outcomes: At the end of this unit, students should be able to

- Comparative study of different refrigerants with respect to properties, applications and environmental issues(L4)
- Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning(L3)
- Calculate cooling load for air conditioning systems used for various operate and analyze the refrigeration and air conditioning systems(L2)

TEXTBOOKS:

1. "A Course in Internal Combustion Engines", M. L. Mathur, R. P. Sharma, Dhanpat Rai & Sons.
2. "Heat Engineering", V.P. Vasandani and D.S. Kumar Metropolitan Book Company, New Delhi.
3. "Refrigeration and Air Conditioning", C P Arora, TMH, 3rd Edition.

REFERENCE BOOKS:

1. "I.C. Engines", V.Ganesan T.M.H., New Delhi, 4th Edition.
2. "Refrigeration and Conditioning", Manohar Prasad, New Age publications, 3rd Edition
3. "Thermodynamics and Heat Engines Vol. II", R. Yadav, Central Publishing House Allahabad, 7th Edition.

Course Code	KINEMATICS OF MACHINERY		L	T	P	C
21A030406			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Introduce various basics mechanisms and applications
- Explain different exact and approximate straight line motion mechanisms
- Explain the concept of instantaneous centre
- Familiarize the concept of velocity and acceleration
- Introduce the gears, gear trains and their applications.
- Describe cams and followers and their motions.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: An understanding of concepts of different of mechanism with lower pairs and higher pairs.

CO2: Gain the knowledge of different types of straight-line motion mechanism and steering gear mechanisms.

CO3: Obtain an in-depth knowledge of finding displacement, velocity and acceleration of different points on different mechanisms using different methods (relative velocity, Instantaneous methods).

CO4: Acquire the knowledge on different gear profiles and calculating the different parameters of gears. Gain the knowledge in designing of gear trains for the required purpose.

CO5: Design and analyze different cam profile for different types of followers.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	3	-	3	-	3	2
CO2	3	3	-	-	-	-	-	-	3	-	3	-	3	2
CO3	3	3	-	-	-	-	-	-	3	-	3	-	3	2
CO4	3	3	-	-	-	-	-	-	3	-	3	-	3	2
CO5	3	3	-	-	-	-	-	-	3	-	3	-	3	2

UNIT-I (13 Hrs)

Mechanisms and Machines: Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs –lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms –inversions of quadric cycle chain – single and double slider crank chain. Mobility of mechanisms.

Learning Outcomes: At the end of this unit, students should be able to

- Contrast the difference between machine and structure (L6)

- Identify the different types of kinematic pairs and kinematic chains (L1)
- Identify the inversions of four bar mechanism (L1)

UNIT-II (10 Hrs)

Straight Line Motion Mechanisms- Exact and approximate, copied and generated types – Peaucellier, Hart and Scott Russel, Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph.

Steering Mechanisms: Conditions for correct steering – Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling) -Single and double Hooke's joint –– applications – Simple problems

Learning Outcomes: At the end of this unit, students should be able to

- Identify the difference between exact and approximate mechanism. (L1)
- Explain the working principles of different mechanisms. (L2)
- Understand the functions of steering gear mechanisms. (L2)
- Understand the difference between Davis and Ackerman's steering gear mechanism. (L2)

UNIT-III (16 Hrs)

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, determination of Coriolis component of acceleration. Klein's construction: Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method.

Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centres in-line theorem – Locating instantaneous centers for simple mechanisms and determination of angular velocity of points and links.

Learning Outcomes: At the end of this unit, students should be able to

- Draw the velocity and accelerations for different configurations (L1)
- Find the velocity and accelerations of different points on and away from different links (L5)
- Understand the concept of instantaneous centers (L2)
- Find the velocity of different points on the links and angular velocities of different links using instantaneous centers method (L5)

UNIT-IV (14 Hrs)

Gears: Higher pairs, toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth- cycloidal and involute profiles. Velocity of sliding –

phenomena of interference – Methods to avoid interference. Condition for minimum number of teeth to avoid interference. Introduction to Helical, Bevel and Worm gearing.

Gear Trains: Introduction –Types of gears – Simple, Compound, Reverted and Epicyclic gear trains, Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Differential gear of an automobile, Simple problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the phenomenon of interference (L2)
- Find the relative merits and demerits of different tooth profiles (L5)
- Understand principle of operation of different gears trains for different purpose (L2)
- Find velocity ratio and torques for different gear trains (L5)

UNIT-V (13 Hrs)

CAMS: Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity, Simple harmonic motion, Cycloidal and uniform acceleration–and retardation, Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the cam terminology (L2)
- Draw the cam profile for different types of follower motion (L1)
- Find the velocity and acceleration of the follower for different types of follower motions(L5)

TEXTBOOKS:

1. "Theory of Machines", S.S. Rattan, Tata McGraw Hill Publishers.
2. "The Theory of Machines", J.E. Shiegley, McGraw Hill

REFERENCE BOOKS:

1. "Theory of Machines", R.S. Khurmi & J.K. Gupta, S. Chand Publications.
2. "Theory of Machines", R.K.Bansal and J S Brar, Laxmi Publications.
3. "Theory of Machines", Thomas Bevan, CBS.
4., "Mechanism and Machine Theory", J.S. Rao and R.V. Dukkipati, New Age Publications
5. "Kinematics and dynamics of machinery", R.L Norton, Tata McGraw Hill Publishers

Course Code	MACHINE TOOLS AND METROLOGY		L	T	P	C
21A030407			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Acquire the knowledge of types of machines and their working principles
- Specifically make the student to improve applications aspect in the measurements and control of process of manufacture

COURSE OUTCOME:

After completion of the course, the student will be able to:

CO1: Understand principle of cutting process and working of lathe, types of lathes and lathe attachments.

CO2: Understand principle working of drilling and boring machines and types.

CO3: Understand principle of milling and grinding machines and types.

CO4: Identify techniques to minimize the errors in measurement and devices for measurement of length, angle.

CO5: Identify measurement of surface roughness, gear & thread parameters also different machine alignment tests.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	1	-	-	1	-	-	2	2	2
CO2	3	-	-	-	3	1	-	-	1	-	-	2	2	2
CO3	3	-	-	-	3	1	-	-	1	-	-	2	2	2
CO4	3	2	-	-	3	1	-	-	1	-	-	2	2	2
CO5	3	2	1	-	3	1	-	-	1	-	-	2	2	2

UNIT-I (14 Hrs)

Metal cutting: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips. Engine lathe – Principle of working, types of lathes, specifications. Taper turning, – Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation. (L2)
- Get familiar with various tooling accessories used in turning and understand different constructions of lathe depending on the nature of operation. (L2)

UNIT-II (12 Hrs)

Drilling and Boring Machines – Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the basic principle of drilling and boring operation, parts of the drilling, (L2)
- Understand shaping and planning machines and tool holding devices, (L2)

UNIT-III (12 Hrs)

Milling machines – Principles of working – Types of milling machines – Geometry of milling cutters, methods of indexing.

Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the principle of milling, grinding, parts of the milling machine and types of milling and grinding machines. (L2)

UNIT-IV (12 Hrs)

Limits, fits and tolerances- Types of Fits - Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly.

Limit Gauges: Taylor's principle, Design of GO and NO-GO gauges, Measurement of angles using Bevel protractor and Sine bar. Measurement of flatness using straight edges, surface plates, optical flat and auto collimator.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the Limits, Fits and Tolerance. Indian standard system – International Standard organization system. (L2)
- Understand the principles of working of the most commonly used instruments for measuring linear and angular distances. (L2)

UNIT-V (12 Hrs)

Surface Roughness Measurement: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand Measurement of surface roughness and tools used to measure roughness. (L2)
- Understand Screw thread measuring methods. (L2)
- Understand Alignment tests on lathe, milling and drilling machine tools. (L2)

TEXTBOOKS:

1. "Machine Tools work shop technology volume 1 & 2", Hajrachoudhury.
2. "Work shop technology volume 1 & 2", raghuwanshi.
3. "Engineering Metrology", R.K. Jain, Khanna Publishers.
4. "Metrology", M. Mahajan

REFERENCE BOOKS:

1. "Principles of Machine Tools", Bhattacharyya A and Sen. G. C, New Central Book Agency.
2. "Fundamentals of Dimensional Metrology", Connie Dotson, Thomson
3. "Fundamentals of Metal Machining and Machine Tools", Geoffrey Boothroyd, McGraw Hill
4. "Principles of Engineering Metrology", Rega Rajendra, Jaico Publishers.
5. "Metrology and Measurement", Bewoor & Kulkarni, Tata Mc Graw Hill Education, 2009

Course Code	APPLIED THERMODYNAMICS LAB		L	T	P	C
21A030408			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To study experimentally the performance of IC engines, compressors, refrigeration and air conditioning systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Conduct various performance tests on I.C engines and plot the performance characteristic curves

CO2: Conduct the load test and evaluate the performance of a reciprocating air compressor

CO3: Conduct a performance test on refrigeration and air conditioning test rigs and determine the C.O.P for the given conditions.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	3	-	1	2	-
CO2	-	-	-	-	-	-	-	-	3	3	-	1	2	-
CO3	3	-	-	-	-	-	-	-	3	3	-	1	2	-

LIST OF EXPERIMENTS:

1. Valve/port timing diagrams of a single cylinder diesel engine.
2. Disassembly / assembly of 4- stroke single cylinder petrol engine.
3. Load test on 4-stroke twin single cylinder diesel engine.
4. Load test on 2-stroke single cylinder petrol engine.
5. Morse test on 4-stroke multi cylinder petrol engine.
6. Motoring and retardation test on 4-stroke single cylinder diesel engine.
7. Heat balance on 4 - stroke single cylinder diesel engine.
8. Performance test on reciprocating air compressor.
9. Performance test on Refrigeration test rig.
10. Performance on Air conditioning and Heat Pump test rig.
11. Performance test on centrifugal blower

Course Code	MACHINE TOOLS AND METROLOGY LAB		L	T	P	C
21A030409			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To import practical exposure to the metrology equipment & Machine Tools
- To conduct experiments and understand the working of the same.

COURSE OUTCOME:

After completion of the course, the student will be able to:

CO1: Understand the working mechanisms and Ability to perform different machining operation on lathe, drilling, milling, slotting and shaping machines.

CO2: Ability to measure different parameters like length, angle, diameter, surface roughness using different measuring instruments.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	-	-	-	2	-	-	-	-	-	-	2	-
CO2	-	3	-	-	-	2	-	-	-	-	-	-	2	-

LIST OF EXPERIMENTS:

1. Step turning on lathe machine
2. Taper turning on lathe machine
3. Thread cutting and knurling on lathe machine (2 exercises)
4. Measurement of cutting forces on lathe
5. Machining of holes using Drilling and boring machines.
6. Gear cutting on the Milling machine
7. Slotting of internal keyway slots using slotting machine.
8. Measurement of lengths, heights, diameters by vernier callipers, micrometers.
9. Measurement of Diameter of bores by internal micrometers and dial bore indicators.
10. Use of gear teeth vernier callipers for checking the chordal addendum and chordal height of the spur gear.
11. Angle and taper measurements by bevel protractor and sine bars.
12. Surface roughness measurement by Tally Surf.

Course Code	COMPUTER AIDED MACHINE DRAWING LAB		L	T	P	C
21A030410			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modelling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modelling of machine parts and their sections.
- Explain creation of 2D assembly drawings from 3D assemblies.
- Familiarize with limits, fits and tolerances in mating components.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Model riveted, welded and key joints using CAD system.
CO2: Create solid models and sectional views of machine components.
CO3: Generate solid models of machine parts and assemble them, translate 3D assemblies into 2D drawings.
CO4: Create manufacturing drawing with dimensional and geometric tolerances.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	3	-	-	-	3	2	-	-	1	2
CO2	2	-	-	-	3	-	-	-	3	2	-	-	1	2
CO3	2	-	-	-	3	-	-	-	3	2	-	-	1	2
CO4	2	-	-	-	3	-	-	-	3	2	-	-	1	2

The following contents are to be done by any 2D software package Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key. Shaft coupling, bushed pin-type flange coupling, universal coupling, Oldhams' coupling.

The following contents to be done by any 3D software package
Sectional views Creating solid models of complex machine parts and create sectional views.

Assembly drawings: (Any four of the following using solid model software)
single tool post, stuffing box, crosshead Lathe tool post, tool head of shaping machine, tail stock, machine vice, gate valve, carburettor, piston, connecting rod, excentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling,

Manufacturing drawing:
Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

TEXTBOOKS:

1. "A text book on Engineering Drawing", K.L.Narayana, P.Kannaiah, SciTech Publications, 2014
2. "Software tools/packages", Auto CAD, Solid works or equivalent.

REFERENCE BOOKS:

1. "Computer Aided Engineering Drawing", Cecil Jensen, Jay Helsel and Donald D. Voisinet, Tata McGraw-Hill, NY, 2000.
2. "Engineering Drawing for Manufacture", James Barclay, Brain Griffiths Kogan Page Science, 2003.
3. "Machine Drawing", N. D. Bhatt, Charotar, 50th Edition, 2014.
4. "Production Drawing", K. L. Narayana, New Age International Publishers, 3rd Edition, 2014

Course Code	PYTHON PROGRAMMING		L	T	P	C
21A050701	(Common to CE, EEE, ME & ECE)		1	0	2	2
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- To understand the object-oriented concepts using Python in problem solving.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Student should be able to understand the basic concepts of Python Programming language such as conditional processing, Loops, and other data structures.

CO2: Ability to explore python especially the built-in objects of Python.

CO3: Ability to create practical and contemporary applications such as Machine Learning algorithms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	3	2
CO2	2	2	2	1	3	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	3	-	-	-	-	-	-	-	3	2

Topics to be covered:

Introduction: What is a program, running python, Arithmetic operators, Value and Types.

Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.

Functions: Function Definitions and Uses, Math functions,

Conditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Recursion, Keyboard input.

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, it's Looping

Tuples: Tuples are immutable, Tuple Assignment

Files: Persistence, Reading and writing, Format operator, Filename and paths,

Classes and Objects: Programmer-defined types, Classes, Objects, methods and modules.

The turtle module & tkinter module: graphics-based Object shapes drawing fundamentals, GUI design Fundamentals

LABORATORY EXPERIMENTS:

1. Install Python Interpreter and use it to perform different Mathematical Computations.
2. Write a Python Program to find sum of given n numbers
3. Write a Python Program to generate Fibonacci Numbers up to a given number
4. Write a Python Program to display multiplication Table of a given Number
5. Write a Python Program to read a list of names from keyboard, sort them and write them into a File
6. Write a Python Program to concatenate two files content and write the result into a new File.
7. Write a Python Program to perform the addition of two matrices.
8. Write a Python Program to search a given word in the given text file and display the number of occurrences of the string.
9. Write the step-by-step Solution procedure to find the LCM and GCD (HCF) of 2 given numbers
10. Find mean, median, mode for the given set of numbers in a list
11. Python Code to create module called "mathematics" having functions add (), subtract(), div(), mul() and access them by another Program.
12. Develop Python program for illustrating the object-oriented features supported by Python
13. Write a function that draws a Pyramid with #symbols

```
        #
      #  ##
    #  #  #  ##
  #  #  #  #  #  ##
```

up to 15 hashes at the bottom

14. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Use object-oriented approach.
15. Using turtles concept draw Olympic Symbol
16. The time module provides a function, also named time that returns the current Greenwich Mean
17. Time in "the epoch", which is an arbitrary time used as a reference point

a. >>> import time
b. >>>time.time () 14377460
   a. 94.5735958

18. Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.
19. Given a text of characters, write a program which counts number of vowels, consonants and special characters.
20. Write program which performs the following operations on list's. Don't use built-in functions
    a) Updating elements of a list
    b) Concatenation of list's
    c) Check for member in the list
    d) Insert into the list
    e) Sum the elements of the list
    f) Push and pop element of list
    g) Sorting of list
    h) Finding biggest and smallest elements in the list
    i) Finding common elements in the list
21. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.
22. Develop Python Program to create Login Screen and evaluate user Input?

TEXTBOOKS:

1. "Think Python", Allen B. Downey, SPD/O'Reilly, 2nd Edition, 2016.

REFERENCE BOOKS:

1. "The Complete Reference: Python", Martin C. Brown, McGraw-Hill, 2018.
2. "Fundamentals of Python", Kenneth A. Lambert, B.L. Juneja, CENGAGE, 2015.
3. "Core Python Programming", R. Nageswara Rao, Dreamtech Press, 2nd Edition, 2019

Course Code	DYNAMICS OF MACHINERY		L	T	P	C
21A030411			3	0	0	3
Pre-requisite	Kinematics of Machines	Semester	V			

COURSE OBJECTIVES:

- To familiarize with the dynamic force analysis of machines and their effects

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Perform force analysis of mechanisms, Design the flywheel for different applications. **(K4)**

CO2: Assess the effect of gyroscopic couple on the stability of vehicles, and speed analysis of the governors. **(K5)**

CO3: Evaluate the effect of friction in devices like bearings, clutches, brakes and Dynamometers. **(K5)**

CO4: Analyze the problems on balancing in rotating and reciprocating machinery. **(K4)**

CO5: Determine the natural frequency of vibrating systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	2	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	2	-	-	-	-	-	1	-	-
CO4	3	3	3	2	-	2	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	3	-	-	-	-	-	1	-	-

UNIT – I (9 Hrs)

Force Analysis: Static force analysis - static equilibrium, static force analysis of four bar and slider crank mechanism, dynamic force analysis - slider crank mechanism, velocity and acceleration of piston, engine force analysis, turning moment on crank shaft.

Flywheel: Turning moment diagrams, fluctuation of energy and speed, fly wheels and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the various forces in different mechanisms. (L4)
- Determine the velocity, and acceleration of the various components of an engine. (L4)
- Design the flywheel. (L5)

UNIT – II (9 Hrs)

Gyroscope*:* Gyroscopic couple, gyroscopic effect on aeroplanes, gyroscopic effect on ship, stability of an automobile, stability of two wheeler.

Governors: Types of governors- Watt, Porter, Proell, Hartnell governor, governor performance - sensitiveness, hunting, isochronism, stability of governor.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Apply gyroscopic principles on Aeroplane, ship, four wheel and two wheel vehicles. (L4)
- Study the basics and definitions related to governors and forces acting on various governors. (L1)
- Solve numerical problems on different governors. (L4)

UNIT – III (10 Hrs)

Bearings & Clutches: uniform pressure theory, uniform wear theory-pivot and collar bearings, clutches - single disc, multiple disc clutch, cone clutch, centrifugal clutch.

Brakes and Dynamometers*:* Types of brakes - block brake, band brake, band and block brake, types of dynamometers - Prony brake, rope brake, belt transmission, epi-cyclic, Bevis Gibson torsion dynamometer.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the basic concepts of friction in pivots and collars with uniform pressure and uniform wear. (L1)
- Solve the numerical problems on brakes, clutches and dynamometers. (L4)

UNIT – IV (8 Hrs)

Balancing of Rotating Masses: Static balancing, dynamic balancing, balancing of rotating masses on same plane and different planes.

Balancing of Reciprocating Masses: Primary and secondary balancing, balancing of in line engines. V engine.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Solve numerical problems on balancing of rotating masses and reciprocating masses in V-engine and multi cylinder engines. (L4)

UNIT – V (9 Hrs)

Vibrations*:* Vibratory motion terminology**,** types of vibrations, basic features of vibrating system, longitudinal vibrations - free longitudinal vibrations, inertia effect of mass of spring, free damped vibrations, logarithmic decrement, transverse vibrations - vibrations of beams carrying single concentrated load, uniformly distributed load, several loads, whirling of shafts, torsional vibrations - free torsional vibrations, single rotor system, two rotor system, three rotor system effect of mass of shaft.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Analyze of the response of one degree of freedom systems with free and forced vibrations. (L3)

- Evaluate the critical speed of the shaft and simple vibration calculations of rotor systems. (L4)

TEXTBOOKS:

1. "Theory of Machines", S.S Ratan, McGraw Hill (India) Private Limited, 5th Edition, 2019.
2. "Design of Machinery", Robert Norton, McGraw Hill (India) Private Limited, 6th Edition, 2020.
3. "Theory of Machines", R. S. Khurmi, S. Chand Publications

REFERENCE BOOKS:

1. "The Theory of Machines", Thomas Bevan, Pearsons Education, 4th Edition, 2009.
2. "Mechanism and Machine Theory", J. S. Rao and R. V. Dukkipati, New Age International Pvt. Ltd., 2nd Edition, 2014.
3. "Theory of Machines", Sadhu Singh, Pearson education, 3rd Edition, 2011.

Course Code	DESIGN OF MACHINE ELEMENTS		L	T	P	C
21A030412			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To impart the knowledge of the basic engineering design against static and fluctuating loads by considering strength and rigidity

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply design procedures using theory of failures for different elements. **(K4)**

CO2: Analyze components under the cyclic loading using Goodman's and Soderberg's criterions. **(K4)**

CO3: Design of Riveted and Bolted joints with different configuration**. (K5)**

CO4: Design of joints ,shafts and shaft couplings for different loading conditions **(K5)**

CO5: Design of various springs to carry the different types of loading. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction: General considerations in the design–Selection of Engineering Materials–properties –Manufacturing consideration in design–BIS codes of steels-preferred numbers.

Stresses in Machine Members: Combined stresses, Principal Stresses, Theories of failure.

Learning Outcomes: At the end of this unit, students should be able to

- Select the engineering Materials for different types of loads and stresses. (L1)
- Analyse the design components using theories of failure for different elements. (L5)

UNIT – II (9 Hrs)

Design for Fatigue Strength

Fluctuating stresses – Introduction to cyclic loading, fatigue failure, S-N curve - endurance limit–estimation of endurance strength, stress concentration– theoretical stress concentration factor, fatigue stress concentration factor, notch sensitivity, design for finite and infinite life-Goodman's line, Soderberg's line, modified Goodman's line.

Learning Outcomes*:* At the end of this unit, students should be able to

- Design simple components under cyclic loading using Goodman's and Soderberg's criteria. (L5)

<u>UNIT – III</u> (9 Hrs)

Riveted Joint, and Bolted Joint

Riveted Joint: Types, efficiency of a riveted joint, eccentrically loaded riveted joints.

Bolted Joint: Design of bolts with pre-tension – Design of joints under eccentric loading.

Learning Outcomes*:* At the end of this unit, students should be able to

- Design riveted joints with different configuration, boiler shell joint design and eccentric loading design of riveted joints. (L5)
- Design bolted joints with direct loading and eccentric loading. (L5)

<u>UNIT – IV</u> (10 Hrs)

Design of Couplings and Cotter Joints

Couplings: Muff, split muff, flange and bushed pin coupling.

Cotter joints-spigot and socket, sleeve and cotter, gib and cotter joints, knuckle joint

Learning Outcomes*:* At the end of this unit, students should be able to

- Design various rigid and flexible shaft couplings. (L4)
- Design cotter joint, knuckle joint and shafts under variable conditions. (L4)

<u>UNIT – V</u> (8 Hrs)

Design of springs

Classification, Stresses and deflections of helical springs – open and closed coiled springs–springs subjected to fatigue loading, co-axial springs, leaf springs.

Learning Outcomes*:* At the end of this unit, students should be able to

- Design of springs based on the type of load and stresses. (L4)

<u>Note:</u> Design data book-allowed for examinations

<u>TEXTBOOKS:</u>

1. "Design of Machine Elements", V. B. Bhandari, TMH Publishers.
2. "Machine Design", R. K. Jain, Khanna Publishers.
3. "Mechanical engineering design", Joseph Edward Shigley, Charles R. Mischke, TMH Publishers.

<u>REFERENCE BOOKS:</u>

1. "Machine Design – An integrated approach", Robert L. Norton, Pearson education India, 2nd Edition.

2. “Machine design”, Dr. N.C. Pandya & Dr. C. S. Shah, Charotar Publishing House Pvt. Limited.
3. “Machine Design”, Sharma and Agrawal, S.K. Kataria & Sons
4. “Design of Machine Elements”, Sadhu Singh, Khanna Publishers
5. “Machine Design”, R.S. Khurmi and J.K. Gupta, S.Chand Publishers, New Delhi
6. “Design of Machine Elements”, Sharma and Purohit, PHI.

Course Code	STEAM ENGINES & GAS TURBINES		L	T	P	C
21A030413			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To develop the necessary analytical and technical contents among engineers in these areas and become familiar with steam power plant, boilers, function of nozzle, gas turbines and jet propulsions.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the key role of quality of steam after evaporation and acquainted with the terms related to steam, steam tables and mollier chart. **(K2)**

CO2: Understand the working of boilers, mountings and accessories, determine the chimney height for maximum discharge. **(K3)**

CO3: Understand the working of Nozzles, condensers and determine their efficiency. **(K4)**

CO4: Understand the working of steam turbines, velocity diagrams and power generation from steam turbines. **(K4)**

CO5: Understand the basic components and working of gas turbine power plant and methods to improve thermal efficiency of plant. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

BASIC CONCEPTS: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the basic concepts of Rankine Cycle and its importance in engineering. (L2)
- Analyze the thermodynamic analysis, concept of mean temperature of heat addition. (L4)
- Adopt methods to improve cycle performance, regeneration, reheating, combined-cycles. (L5)

UNIT – II (8 Hrs)

BOILERS: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers – Mountings and Accessories.

DRAUGHT: Classification – Height Of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney – Artificial Draught, Induced and Forced Draught.

Learning Outcomes*:* At the end of this unit, students should be able to

- Define the Working Principles & Pressures of Operation - L.P & H.P. Boilers, Mountings and Accessories. (L1)
- Analyze the Condition for Maximum Discharge. (L4)
- Explain the Efficiency of Chimney, Artificial Draught, Induced and Forced Draught. (L2)

UNIT – III (8 Hrs)

STEAM NOZZLES: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio.

CONDENSERS: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

Learning Outcomes*:* At the end of this unit, students should be able to

- Apply Assumptions Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle. (L3)
- Explain the Air Leakage Vacuum Efficiency, condenser efficiency, problems. (L2)

UNIT – IV (10 Hrs)

STEAM TURBINES:

IMPULSE TURBINE: Mechanical Details – Velocity Diagram – Effect of Friction – Power Developed, Axial Thrust Blade or Diagram Efficiency – Condition for Maximum Efficiency.

REACTION TURBINE: Mechanical Details – Principle of Operation, Thermodynamic Analysis of a Stage, Degree of Reaction –Velocity Diagram –Condition for Maximum Efficiency.

Learning Outcomes*:* At the end of this unit, students should be able to

- Explain the Power Developed, Axial Thrust Blade or Diagram Efficiency, Condition for Maximum Efficiency. (L2)
- Analyze the Thermodynamic Analysis of a Stage, Degree of Reaction,Velocity Diagram, Condition for Maximum Efficiency. (L4)

UNIT – V (10 Hrs)

GAS TURBINES: Simple Gas Turbine Plant – Ideal Cycle, Essential Components – Parameters of Performance – Actual Cycle – Regeneration, Inter Cooling and Reheating – Closed And

Semi-Closed Cycles – Merits and Demerits, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants.

Learning Outcomes*:* At the end of this unit, students should be able to

- Apply the Parameters of Performance – Actual Cycle – Regeneration, Inter Cooling and Reheating. (L3)
- Explain the Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants. (L2)

TEXTBOOKS:

1. "Thermal Engineering", R.K. Rajput, Lakshmi Publications, 9th Edition 2013
2. "Basic and Applied Thermodynamics", P.K. Nag, TMH, 2nd Edition, 2012.

REFERENCE BOOKS:

1. "Gas Turbines", V. Ganesan, TMH
2. "Thermodynamics and Heat Engines", R. Yadav, Central Publishing House, Allahabad, 2002.
3. "Thermal Engineering", Mahesh M Rathore, McGraw Hill, 2010
4. "Gas Turbines and Propulsive Systems", P. Khajuria & S. P. Dubey, Dhanpatrai
5. "Thermal Engineering", R.S Khurmi & JS Gupta, S. Chand, 2012.
7. "Thermal Engineering Data Book", B.S. Reddy and K.H. Reddy, I.K. International, 2007.
8. "Steam Tables SI Units", Dr. B. Umamaheswar Gowd and A. Nagraju, Siri Publ.

Course Code	FINITE ELEMENT METHODS		L	T	P	C
21A030414			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To learn the principles involved in discretization in finite element approach, form stiffness matrices and force vectors for simple elements
- To find the various approach followed in finite element approach, use the various elements for discretization and learn about shape functions.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply basic principles and approaches for solving FEM problems in different fields. **(K5)**

CO2: Analyze the stresses and deformation in bars, beams and trusses under different loading conditions using FEM. **(K5)**

CO3: Formulate the interpolation functions for higher order iso-parametric elements. **(K5)**

CO4: Analyze the stresses and deformation in CST elements using FEM. **(K5)**

CO5: Solve the temperature distribution in 1-D, 2-D in in composite walls one dimensional and two-dimensional fins using FEM, **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	-	2	-	-	-	-	-	-	3	3
CO3	3	3	2	2	-	2	-	-	-	-	-	-	3	3
CO4	3	3	3	3	-	2	-	-	-	-	-	-	3	3
CO5	3	3	3	3	-	2	-	-	-	-	-	-	3	3

UNIT – I (9 Hrs)

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces and point loads, stress strain relations in 3D elasticity, plane stress and plane strain, Boundary conditions, Initial conditions. Approximate methods for solving the differential equations: Rayleigh-Ritz method, Weighted residual methods, Galerkin's method.

Integral formulation: Principle of a minimum potential energy, principle of virtual work, Generalized Finite element approach in solving these problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand and solve FEM problems using basic principles in different fields. (L3)

UNIT – II (10 Hrs)

Problems with One-dimensional geometry:

Bars: Formulation of stiffness matrix, Load vectors, Incorporation of boundary conditions: Elimination approach and penalty approach.

Trusses: Plane truss and space truss elements, Example problems involving plane truss elements. Examples involving multi point constrains. Stress calculations.

Beams: Bending of beams, Interpolation functions, formulation of stiffness matrix and load vectors.

Learning Outcomes: At the end of this unit, students should be able to

- Solve problems using FEM technique for different structure members under different loading condition. (L3)

UNIT – III (9 Hrs)

Interpolation Models: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal Triangle, Linear interpolation polynomials in terms of global coordinates for triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates for triangular (2D simplex) elements, quadrilateral element.

Higher Order And Isoparametric Elements: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic.

Learning Outcomes: At the end of this unit, students should be able to

- Formulate interpolation functions to higher order isoparametric elements. (L4)
- Understand basic concepts of isoparametric elements. (L1)

UNIT – IV (9 Hrs)

Finite Element Application In Solid Mechanics: Problem modeling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Iso parametric, sub parametric and super parametric elements. Interpolation, Jacobian matrices relating strain and nodal displacements, stiffness matrix formulation, Consistent and lumped load vectors, Numerical integration Gaussian quadrate.

Learning Outcomes: At the end of this unit, students should be able to

- Derive shape functions and element stiffness matrices for various elements. (L3)

UNIT – V (8 Hrs)

Heat Transfer And Fluid Mechanics Problems: Steady state heat conduction with convective and heat flux boundary conditions, Functional approach, Galerkin approach formulation of element characteristic matrices and vectors in 1D and 2D problems. Temperature distribution in composite walls one dimensional and two-dimensional fins.

Learning Outcomes: At the end of this unit, students should be able to

- Solve heat transfer problems using FEM and apply boundary conditions in realistic problems. (L3)

TEXTBOOKS:

1. "Introduction to Finite Element in Engineering", Tirupati Chandrapatla and Bellagundu, Pearson Education, New Delhi.
2. "Finite Element Methods", S. S. Rao, Pergamom Press, NewYork

REFERENCE BOOKS:

1. "Finite Element Method", R. Dhanaraj, K. Prabhakaran Nair, Oxford University Press
2. "Introduction to FEM", J. N. Reddy, TMH Publishers, New Delhi.
3. "Finite Element Analysis", C.S. Krishna Moorthy, TMH Publishers, New Delhi.

Course Code	NON DESTRUCTIVE EVALUATION		L	T	P	C
21A030415			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize with the concepts of various NDT techniques to identify the defect in a mechanical component

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the test procedure of industrial radiography. **(K1)**
CO2: Estimate the defects in a mechanical component by ultrasonic test**. (K3)**
CO3: Examine the surface defects of a test specimen using the liquid penetrant test. **(K3)**
CO4: Detect the internal flaws in a mechanical component by magnetic particle test. **(K3)**
CO5: Evaluate and interpret the results of eddy current test to detect the discontinuities. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	3	3	-	2	-	-	-	-	-	-	-
CO3	3	3	-	3	3	-	2	-	-	-	-	-	-	-
CO4	3	3	-	3	3	-	2	-	-	-	-	-	-	-
CO5	3	3	-	3	3	-	2	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction to NDT: Overview of non-destructive testing, classification of material tests, Selection of NDT methods, Visual Inspection

Radiography test: Sources of X and Gamma Rays, Their properties and interaction with matter, Radiographic test**,** Film characteristics, Radiographic equipment, Radiographic techniques, Safety aspects of industrial radiography, Industrial applications of radiography test

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of Radiographic test. (L2)
- Outline the concepts of sources of X and Gamma Rays. (L2)
- Explain the radiographic techniques. (L2)
- Discuss the safety aspects of industrial radiography. (L4)

UNIT – II (8 Hrs)

Ultrasonic Test: Principle of wave propagation, Reflection, Refraction, Diffraction, Mode conversion and Attenuation, Sound field, Piezo-electric effect, Ultrasonic transducers and their characteristics, Ultrasonic equipment and variables affecting ultrasonic test, ultrasonic testing, Interpretations and guidelines for acceptance/rejection, Effectiveness and Limitations of Ultrasonic Testing, Industrial applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the principle of ultrasonic test. (L3)
- Analyze the performance of wave propagation, reflection, refraction, diffraction and sound field in ultrasonic test. (L4)
- Discuss the characteristics of ultrasonic transducers. (L2)
- Outline the limitations of ultrasonic testing. (L2)

UNIT – III (10 Hrs)

Liquid Penetrant Test: Basic concepts- cohesion, adhesion, capillary action, Liquid penetrant system, Surface preparation, Test procedure, Examination, interpretation and evaluation, Effectiveness, limitations and industrial applications of liquid penetrant testing.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the procedure of Liquid Penetrant tests. (L2)
- Outline the limitations of Penetrant tests. (L2)
- Explain the effectiveness of Penetrant tests. (L2)

UNIT – IV (9 Hrs)

Magnetic Particle Test: Magnetic materials, Magnetization of materials, Demagnetization of materials, Principle of magnetic particle test, Magnetic particle test equipment, Magnetic particle test procedure, Standardization, Calibration, Interpretation and evaluation, Industrial applications and limitations of the magnetic particle test.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the procedure of magnetic particle tests. (L2)
- Outline the limitations of magnetic particle tests. (L2)
- Explain the effectiveness of magnetic particle tests. (L2)
- Apply the applications of Magnetic particle test. (L3)

UNIT – V (9 Hrs)

Eddy Current Test: Principle of eddy current, Factors affecting eddy currents, Impedance diagram, Eddy current test system, Test coils, Standardization and calibration, Effectiveness and industrial applications of eddy current testing.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the procedure of eddy tests. (L2)
- Outline the limitations of eddy current tests. (L2)
- Explain the effectiveness of eddy current tests. (L2)

TEXTBOOKS:

1. "Non-Destructive Test and Evaluation of Materials", J Prasad and GCK Nair, Tata McGraw-Hill Education, 2nd Edition.
2. "Practical Non Destructive Testing", B Raj, T Jayakumar and M Thavasimuthu, Alpha Science International Limited, 3rd Edition

REFERENCE BOOKS:

1. "Ultrasonic inspection training for NDT", E. A. Gingel, Prometheus Press.
2. ASTM Standards Volume 3.01 : Metals and alloys.
3. "Non-Destructive - Hand Book", R. Hamchand.

Course Code	MECHANICAL VIBRATIONS		L	T	P	C
21A030416			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize with the concepts of mathematical model and solution methods for vibrations of the mechanical systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the significance of vibration analysis in machine parts. **(K2)**

CO2: Analyze the mathematical model of single degree of freedom systems under damped and undamped free vibrations. **(K5)**

CO3: Model single degree of freedom systems under forced vibrations **(K3)**

CO4: Model two degree of freedom systems and determine their responses under un-damped and damped vibrations. **(K3)**

CO5: Learn various measuring instruments. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	2	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	2	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	2	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	2	-	-	-	-	-	-	-	-

UNIT – I (8 Hrs)

Fundamentals of Vibration: Elements of vibrating system, types of vibrations, methods of vibration analysis, equation of motion of spring - mass system, damping elements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the causes of vibration and techniques of damping. (L1)
- Solve problems on various types of damping systems. (L3)

UNIT – II (9 Hrs)

Free Vibrations of Single Degree of Freedom Systems

Undamped Free Vibrations: Governing differential equation, Newton's method, Energy method, Rayleigh's method, torsional system – equations of motion and solution.

Damped Vibrations: Governing differential equation, critical damping coefficient and damping ratio, damped natural frequency, logarithmic decrement, energy dissipated in viscous damping.

Learning Outcomes: At the end of this unit, students should be able to

- Determine natural frequency of damped and undamped single degree freedom systems. (L3)
- Analyse the behaviour of single degree freedom systems with damping under free vibrations. (L4)

UNIT – III (10 Hrs)

Forced Vibrations of Single Degree of Freedom Systems: Sources of Excitation, Response of damped and undamped systems to harmonic excitation; frequency response curve; magnification factor; harmonic excitation of the base, vibration isolation, transmissibility, force transmission to foundations; Response of a damped system
under rotating unbalance.

Learning Outcomes: At the end of this unit, students should be able to

- Determine natural frequency of damped and undamped single degree freedom systems under forced vibrations. (L3)
- Analyse the behaviour of single degree freedom systems with damping under forced vibrations. (L4)

UNIT – IV (10 Hrs)

Two degree of freedom system: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the two degree freedom systems with and without damping. (L4)
- Solve problems on vibration absorber. (L5)

UNIT – V (8 Hrs)

Vibration measuring instruments: Transducers - variable resistance transducers, piezoelectric transducers, working principle of Seismic mass, vibrometer, accelerometer, vibration exciters.

Learning Outcomes: At the end of this unit, students should be able to

- Explains about function of variation of Vibration Measuring Devices. (L2)

TEXTBOOKS:

1. "Mechanical Vibrations", G.K. Grover &Nigam, Nem Chand and Brothers, 8th Edition.
2. "Mechanical vibration", S.S. Rao, Pearson India, 4th Edition.

REFERENCE BOOKS:

1. "Theory of Vibration with Application", Thomson, Pearson India, 5th Edition.
2. "Mechanical vibration", V. P. Singh, Dhanpat Rai & Co.
3. "Mechanical vibration", Schaum Series, McGraw Hill, 2nd Edition.

Course Code	COMPUTER AIDED ENGINEERING LAB		L	T	P	C
21A030417			0	0	3	1.5
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To impart fundamental knowledge to students in the latest technological topics on Computer Aided Engineering Analysis.
- To learn the theory and characteristics of finite elements that represent engineering structures.
- Apply finite element solutions to structural, thermal, dynamic problem.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand various tools used in analysis software. **(K2)**
CO2: Perform structural analysis for different elements. **(K4)**
CO3: Perform thermal analysis for different elements under different modes of heat transfer. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	2	2	-	-	-	-
CO2	-	-	2	-	2	-	-	-	-	2	-	-	-	-
CO3	-	-	-	-	-	-	-	-	2	2	-	-	-	-

LIST OF EXPERIMENTS:

I. Introduction to Analysis Software Package

II. Structural analysis:

a) Analysis of a bar with constant cross-sectional area.
b) Static Analysis of Prismatic bar.
c) Analysis of a truss member under loading.
d) Static Analysis of beam
e) Analysis of a rectangular plate with a hole.
f) Analysis of a bracket plate with eccentric loading.
g) Static Analysis of a Corner Bracket.
h) Analysis of Hinged support member.

III. Thermal analysis:

a) Analysis of a square plate considering conduction.
b) Analysis of a square plate considering conduction and convection.

TEXTBOOKS:

1. "Ansys 2020: Structural Analysis using the Ansys Mechanical Apdl Release 2020 R1 Environment", R. B. Chowdary, Wiley India.

REFERENCE BOOKS:

1. "Working with Ansys: A Tutorial approach", Divya Zindani and Apurba Kumar Roy, Wiley India.

Course Code	MACHINE DYNAMICS LAB		L	T	P	C
21A030418			0	0	3	1.5
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To equip the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations.
- To develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
- To develop understanding of dynamic balancing, gyroscopic forces and moments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the amplitudes for different suspension and damping systems. **(K4)**

CO2: Determine the radius of gyration for different suspension and damping systems. **(K4)**

CO3: Determine the balancing of rotating masses for different suspension and damping systems. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	2	3	2	3	-	-	-	-	-	-	-	-
CO2	1	-	2	3	-	3	-	-	-	-	-	-	-	-
CO3	-	-	3	-	2	2	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS:

1. Determination of steady state amplitude of a forced vibratory system
2. Static balancing using steel balls.
3. Determination of the magnitude and orientation of the balancing mass in dynamic balancing.
4. Determination of the magnitude of gyroscopic couple, angular velocity of precession, and representation of vectors.
5. Single rotor system with viscous damping.
6. Determination of vibration of helical spring mass system.
7. Determination of radius of gyration using bi-filar suspension.
8. Determination of vibration of two rotor system.
9. Determination of radius of gyration using compound pendulum.
10. Determination of MOI using Tri-filar suspension

TEXTBOOKS:

1. "Mechanical Vibrations", G.K. Grover & Nigam, Nem Chand and Brothers, 8^{th} Edition.

REFERENCE BOOKS:

1. "Mechanical vibration", V. P. Singh, Dhanpat Rai & Co..

Course Code	DESIGN THINKING AND PRODUCT INNOVATION LAB		L	T	P	C
21A030702			1	0	2	2
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To develop products/models by 3D printing.
- To design measuring devices for temperature, pressure, humidity, water level, smart lighting
- To design pneumatic and hydraulic circuits

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop 3D models using 3D printing. (K3)
CO2: Design the system with measuring devices. (K5)
CO3: Design hydraulic / pneumatic circuits. (K5)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	1	-	-	2	-	-	-	1	-	-	-	-
CO2	-	-	2	1	1	-	-	-	-	-	-	2	-	-
CO3	-	3	1	3	3	2	-	-	-	-	-	-	-	-

List of Experiments:

1. 3D Printing
   a. To develop a CAD model and simulate in CAE environment.
   b. To develop tooling and make a physical prototype (Two Exercises).
2. To design a device for measurement of Temperature/ pressure.
3. To design a device for measurement of Humidity.
4. To design a device for Water Level Indicator.
5. To design a Smart Lighting system.
6. To design Automatic Car Wiper/ safety issues in Automobiles.
7. Design of simple pneumatic and hydraulic circuits using basic components.
8. Design of pneumatic circuit for speed control of double acting cylinders.
9. Design a hydraulic circuit by using Flow Control Valves for simple application.
10. Design and Simulation of a Hydraulic Shaper.
11. Design and Simulation of a Hydro Electric Circuit for simple application.

TEXTBOOKS:

1. "Design Thinking Methodology Book", Emrah Yayici, Wiley India.

REFERENCE BOOKS:

1. "Design Thinking for Innovation: Research and Practice", Walter Brenner, Springer Publications.

Course Code	UNIVERSAL HUMAN VALUES (Common to all branches)		L	T	P	C
21A000003			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the significance and need of values in the society. **(K2)**

CO2: Understand the meaning of Harmony in the Self the Co-existence of Self and Body. **(K2)**

CO3: Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society **(K2)**

CO4: Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. **(K3)**

CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-

UNIT – I (9 Hrs)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the significance and need of values in the society. (L2)

UNIT – II (9 Hrs)

Understanding Harmony in the Human Being - Harmony in Myself: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programs to ensure self-regulation and Health.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the meaning of Harmony in the Self the Co-existence of Self and Body. (L2)
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. (L2)

UNIT – III (9 Hrs)

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order

Learning Outcomes: At the end of this unit, students should be able to

- Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society (L2)

UNIT – IV (9 Hrs)

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at all Levels, and the Holistic Perception of Harmony in Existence.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. (L3)

UNIT – V (9 Hrs)

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Learning Outcomes: At the end of this unit, students should be able to

- Identify the scope and characteristics of people friendly and eco-friendly production systems. (L2)
- Develop appropriate technologies and management patterns for above production systems. (L3)

- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. (L3)

TEXTBOOKS:

1. "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

REFERENCE BOOKS:

1. "Jeevan Vidya: Ek Parichaya", A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. "Human Values", A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. "The Story of My Experiments with Truth", Mohandas Karamchand Gandhi
5. "Small is Beautiful", E. FSchumacher.
6. "Slow is Beautiful", Cecile Andrews
7. "Economy of Permanence", J C Kumarappa
8. "Bharat Mein Angreji Raj", Pandit Sunderlal
9. "Rediscovering India", Dharampal,
10. "Hind Swaraj or Indian Home Rule", Mohandas K. Gandhi,
11. "India Wins Freedom", Maulana Abdul Kalam Azad
12. "Vivekananda", Romain Rolland (English)
13. "Gandhi", Romain Rolland (English)

ONLINE LEARNING RESOURCES:

1. http://www.uhv.org.in/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://www.studocu.com/in/document/dr-apj-abdul-kalam-technical-university/universal-human-valuestechnical-communication/uhv-best-notes/31376289

Course Code	HEAT TRANSFER		L	T	P	C
21A030419			3	0	0	3
Pre-requisite	Fluid Mechanics and Hydraulic Machinery, Applied Thermodynamics	Semester	VI			

COURSE OBJECTIVES:

- To introduce various modes of heat transfer and their significance in the design of various heat transfer equipment.
- To determine the rate of heat transfer through simple geometries in steady state and find the critical radius of insulation in case of steam pipes and electrical cables.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Evaluate the rate of heat transfer from a finned surface and the time of cooling or heating in transient heat conduction problems. **(K5)**

CO2: Compute convective heat transfer coefficients in forced and natural convection, both for internal and external flows. **(K3)**

CO3: Find the convective heat transfer coefficient in boiling and condensation. **(K1)**

CO4: Design a heat exchanger using LMTD or NTU method. **(K6)**

CO5: Calculate the radiation heat exchange between the surfaces and interpret the significance of radiation shields. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (10 Hrs)

Introduction: Modes of heat transfer, Basic laws of heat transfer, applications of heat transfer.

Conduction Heat Transfer: Fourier Law of Heat conduction, General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates. Simplification and forms of the field equation, steady, unsteady heat transfer, Initial and boundary conditions.

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres, Electrical Analogy, Composite slabs, cylinders and spheres, Thermal Contact Resistance, Critical radius of insulation, systems with heat generation.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the phenomenon related to different modes of heat transfer. (L1)
- Compare different types of conduction heat transfer. (L2)

- Apply concept of thermal resistance and its importance in practical problems. (L3)

UNIT – II (7 Hrs)

Extended surface (Fin) Heat Transfer: Long Fin, Fin with insulated tip and Short Fin, Efficiency and effectiveness of fins.

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance, Significance of Biot and Fourier Numbers, Heisler Chart solutions of transient conduction systems.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the phenomenon related to different modes of heat transfer. (L1)
- Compare different types of conduction heat transfer. (L2)

UNIT – III (9 Hrs)

Convective Heat Transfer: Classification of Convective Heat Transfer, Dimensional analysis-Buckingham Pi Theorem for forced and Natural convection. Non-Dimensional Numbers.

Forced convection: Concepts of hydrodynamic and thermal boundary layer, use of empirical correlations for forced convective heat transfer -Internal flows and External flows.

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate, Use of empirical relations for Vertical plates and cylinders.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the convective heat transfer principles. (L3)
- Use analogy between fluid friction and heat transfer. (L3)
- To estimate the convention heat to differentiate between forced and free convection engineering problems. (L2)

UNIT – IV (10 Hrs)

Heat Transfer with Phase Change:

Boiling: Pool boiling, Regimes - Nucleate boiling and Film boiling, Critical Heat flux, Flow boiling.

Condensation: Film wise and drop wise condensation, Film condensation on vertical and horizontal cylinders, using empirical correlations.

Heat Exchangers: Classification, overall heat transfer Coefficient, fouling factor, Design of Heat Exchangers - LMTD and NTU methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of different types of heat exchangers. (L2)
- Calculate the heat transfer in heat exchangers. (L2)
- Design a heat exchanger for a given application. (L3)
- Interpret the basic modes of condensation heat transfer. (L2)

- Identify different regimes of boiling in design of boilers. (L3)
- Understand the basic mechanism of mass transfer. (L2)
- Differentiate between mass transfer due to convection and diffusion. (L4)

UNIT – V (9 Hrs)

Radiation Heat Transfer: Basic concepts, Emission characteristics, concept of black body, laws of black-body radiation - Planck's law, Wien's displacement law, Stefan Boltzmann law, radiation incident on a surface, solid angle and radiation intensity, lambert's cosine law, heat exchange between two black surfaces, shape factor, heat exchange between non-black surfaces, radiosity, electrical analogy for radiation networks, radiation shields.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the principles of radiation heat transfer. (L3)
- Calculate the radiation heat transfer between two bodies. (L2)
- Design a radiation shield for given conditions. (L3)
- Examine the effect of greenhouse gases on atmosphere. (L4)

TEXTBOOKS:

1. "Heat and Mass Transfer", Yunus Cengel, Afshin Ghajar, Tata McGraw Hill, 6th Edition.
2. "Heat and Mass Transfer", P.K. Nag, Tata Mc Graw Hill Publications, 3rd Edition.

REFERENCE BOOKS:

1. "Fundamentals of Heat Transfer & Mass Transfer", Incropera & Dewitt, John Wiley Publications, 6th Edition.
2. "Heat transfer", J. P. Holman, Mc Graw Hill, 8th Edition.
3. "Heat transfer - A basic Approach", Ozisic M. Necati, McGraw Hill company.

Course Code	MECHATRONICS AND MEASUREMENTS		L	T	P	C
21A030420			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart knowledge on design of complex engineering systems using sensors, actuators, and controllers.
- To introduce working of different physical parameters like displacement, speed, stress and strain, force, torque, temperature and flow.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the principles of mechatronics systems, Design of mechatronics system, control systems and microprocessor-based controllers. **(K2)**

CO2: Understand the working principles of Hydraulic and pneumatic actuating systems. **(K2)**

CO3: Choose the appropriate instrument to measure the physical parameters like displacement, speed, stress and strain. **(K3)**

CO4: Choose the appropriate instrument to measure the physical parameters like, pressure, temperature and flow. **(K3)**

CO5: Understand the working of Measurement of Acceleration and Vibration, stress strain measurement and choose the appropriate instrument to measure the physical parameters force and torque. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Mechatronics Systems: Mechatronics systems- Elements & levels of mechatronics system, mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understanding design of mechatronics. (L2)
- Various mechatronics systems. (L4)
- Design Aspects of mechatronics systems. (L2)

UNIT – II (9 Hrs)

Hydraulic and Pneumatic Actuating Systems: Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

Learning Outcomes: At the end of this unit, students should be able to

- Classify various actuation systems. (L2)
- Choose the criterion for different actuators. (L1)

<u>UNIT – III</u> (10 Hrs)

Measurement systems: Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification, and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization, and Photo electric transducers, Calibration procedures.

Measurement Of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Non- contact type of tachometer.

Learning Outcomes: At the end of this unit, students should be able to

- List various types of transducers used for the measurement of displacement and speed. (L1)
- Explain the static and dynamic characteristics of transducers. (L3)
- Classify the transducers with respect to change in resistance, capacitance and inductance. (L4)

<u>UNIT – IV</u> (8 Hrs)

Measurement Of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement– Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

Learning Outcomes: At the end of this unit, students should be able to

- Identify various types of transducers used for the measurement of temperature, pressure and flow. (L3)
- Explain methods of measurement of temperature, pressure. (L2)
- Develop the techniques for calibration of temperature, pressure and flow measuring devices. (L3)

UNIT – V (9 Hrs)

Measurement of Acceleration and Vibration: Different simple instruments-Principles of Seismic instruments – Vibrometers and accelerometers.

Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

Measurement of Force, Torque and Power: Elastic force meters, load cells, Torsion meters, Dynamometers.

Learning Outcomes: At the end of this unit, students should be able to

- Measure the acceleration and vibration using of Seismic instruments. (L2)
- Identify various types of transducers used for the measurement of force, torque and power. (L1)
- Explain methods of measurement of force, torque. (L2)
- Develop the techniques for calibration of force, torque. (L3)
- Experimental with measurement of strain. (L3)

TEXTBOOKS:

1. "Mechanical Measurements", R.K Rajput, S. Chand & Co.
2. "Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering", W. Bolton, Pearson, 4th Edition ,2012.

REFERENCE BOOKS:

1. "Mechanical and Industrial Measurements", R.K. Jain, Khanna Publishers
2. "Instrumentation & mechanical Measurements", A.K. Tayal, Galgotia Publications
3. "Mechatronics System Design", Devdas Shetty, Richard A. Kolk, Thomson Learning Publishing Company, 2001.

Course Code	DESIGN OF TRANSMISSION ELEMENTS		L	T	P	C
21A030421			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To familiarize with the design of various machine elements for effective power transmission.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design of various belts, rope, and chain drive power transmission elements. **(K6)**
CO2: Design of Journal, Ball and Roller bearings. **(K6)**
CO3: Design of Engine parts like connecting rod, crank, crank shaft, crank pin. **(K6)**
CO4: Design of spur gear, helical gear, bevel gear and worm gear. **(K6)**
CO5: Design of power screws and gear boxes. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	3	-	-	-	-	-	-	-	-	-
CO5	3	3	2	1	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Flat belt Drives and Pulleys: Introduction to belt drives, belt materials, belt tensions, transmission of power by flat belt, design of flat belt drive and pulley.

V-Belt, Rope and Chain Drives: Design and selection of V- belt drives and rope drives, design of pulley for V-belt and rope drive, design of Chain drives.

Learning Outcomes: At the end of this unit, students should be able to

- Solve problem on design of flat belt drives. (L3)
- Choose various types of flexible power transmission systems. (L3)

UNIT – II (10 Hrs)

Journal Bearings: classification of bearings, journal bearing materials – full and partial bearings- lubrication – bearing modulus —heat dissipation of bearings – design of journal bearing.

Ball and Roller Bearings: classification and selection of ball and roller bearings, static and dynamic load rating, bearing life- reliability, load-life relations.

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate the importance of bearings in the transmission system. (L2)
- Design sliding contact bearing using Somerfield number. (L4)

- Identify the factors required for the selection rolling contact bearings. (L2)

UNIT – III (9 Hrs)

Engine Parts: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts.

Learning Outcomes: At the end of this unit, students should be able to

- Predict various forces and stresses acting on the Engine parts. (L3)
- Identify the Engine parts. (L2)
- Design of engine parts like connecting rod, crank, crank shaft and crank pin. (L4)

UNIT – IV (8 Hrs)

Design of Spur and Helical Gear Drives: Spur gears and helical gears – Forces, Lewis beam strength Equation.

Design of Bevel and Worm Gear Drives: Bevel gears and Worm gears – Forces, Lewis beam strength Equation.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Kinematics of different types of gears. (L2)
- Design a spur gear. (L5)
- Identify the differences between the helical gear and a bevel gear. (L2)
- Solve problems on the design of helical gear. (L3)
- Explain the kinematics of helical, straight bevel gears and worm gears. (L3)
- Predict the various forces acting on the worm gear tooth. (L3)
- Select of helical, bevel and worm gears in power transmission. (L3)

UNIT – V (9 Hrs)

Design of power screws: Design of screw - Square, ACME, Buttress screws, design of nut.

Gear Box Design- Introduction – types-sliding mesh, constant mesh, kinematics of gear boxes–ray diagram

Learning Outcomes: At the end of this unit, students should be able to

- Design of screws like Square, Butter and nuts. (L5)
- Design of different types of gear boxes. (L5)

Note: Design Data Book Allowed for Examination

TEXTBOOKS:

1. "Machine design", N.C. Pandya and C. S. Shah, Charotar Publishing House Pvt. Limited.
2. "Introduction to Machine Design", V. B. Bandari, TMH Publishers.

3. “Design of Transmission Elements”, T J Prabhu
4. “Design Data Handbook”, M D Jalaluddin

REFERENCE BOOKS:

1. “Mechanical engineering design”, Joseph Edward Shigley, Charles R. Mischke, TMH Publishers.
2. “Machine Design – An integrated approach”, Robert L. Norton, Pearson education India, 2nd Edition.
3. “Machine Design”, T.V. Sundaraja Murthy, Anuradha Publications.
4. “Design of Machine Elements”, Sadhu Singh, Khanna Publishers

Course Code	UNCONVENTIONAL MACHINING PROCESSES		L	T	P	C
21A030422			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart the principles of non-traditional machining methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the types, needs and application of unconventional machining process. **(K2)**
CO2: Discuss the various mechanical energy based machining methods. **(K2)**
CO3: Distinguish the chemical and electro chemical energy based machining processes. **(K2)**
CO4: Explain electrical energy based machining processes for specific application. **(K2)**
CO5: Explain the principle and working of thermal energy based machining methods. **(K2)**
CO6: Examine the significance of various process parameters on MRR. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	2	-	-	-	-

UNIT – I (8 Hrs)

Introduction: Need for non-traditional machining methods, classification of modern machining Processes – considerations in process selection, applications.

Ultrasonic machining – Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

Learning Outcomes: At the end of this unit, students should be able to

- To get brief knowledge about difference between conventional and non conventional machining process. (L1)
- Illustrate the process parameters in ultrasonic machining, mechanism of metal removal. (L2)

UNIT – II (9 Hrs)

Abrasive Jet Machining: Working principle, machine set-up, process parameters, MRR, effect of process parameters, advantages, limitations and applications.

Water Jet Machining: Working principle, machine set-up, process parameters and process performance, advantages, limitations and applications.

Abrasive Water Jet Machining: working principle, machining set up, nozzle designs, parametric analysis, advantages, limitations and applications.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the Abrasive jet machining, working principle and process parameters of Abrasive jet machining. (L2)
- Know about the water jet machining, working principle and process parameters of water jet machining. (L2)
- Know about the Abrasive water jet machining, working principle and process parameters of Abrasive water jet machining. (L2)

<u>UNIT – III</u> (8 Hrs)

Electro–Chemical Machining: Principle, Electrochemistry of the process, ECM Set-up, elements of the process, modelling of MRR, Process parameters, effect of process parameters on machining accuracy, Electro-Chemical Grinding: Principle, set-up, process characteristics, Electro-Chemical Honing – Electro-Chemical Deburring, Chemical Machining- Steps-methods**,** advantages, limitations and applications of above processes.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about Electro chemical machining process working. (L2)
- Describe about the Electro chemical grinding and honing machining process. (L2)

<u>UNIT – IV</u> (10 Hrs)

Electric Discharge Machining: Principle, set-up, elements, EDM circuits, Metal removal rate, surface finish, effect of process parameters, machining accuracy, characteristics, advantages, limitations and applications.

Electric Discharge Grinding: Working principle, elements of the process, difference between EDM and EDG

Wire-Electric Discharge Machining: working principle, set-up, elements, process variables and characteristics, advantages, limitations and applications.

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate about the Electric discharge machining process. (L3)
- Describe about the Electric discharge grinding process. (L2)
- Learn about wire electric discharge machining working. (L2)

<u>UNIT – V</u> (10 Hrs)

Electron Beam Machining: working principle, mechanism of metal removal, machining set-up, MRR, process parameters, characteristics, advantages, limitations and applications.

Laser Beam Machining: Lasing process, operation of LBM, mechanics of LBM, process characteristics, thermal features, advantages, limitations, and applications.

Plasma Arc Machining: Generation of plasma, principle of operation, elements, plasma torch design, modes of operation of plasma torch, process parameters, advantages and applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the Electron beam machining working. (L2)
- Illustrate about the Laser beam machining. (L4)
- Describe about the plasma arc machining. (L2)

TEXTBOOKS:

1. "Advanced machining processes", VK Jain, Allied publishers.
2. "Non-traditional machining methods", Benedict, CRC Press

REFERENCE BOOKS:

1. "Modern Machining Process", Pandey P.C. and Shah H.S, TMH.
2. "New Technology", Bhattacharya A, The Institution of Engineers, India.

Course Code	AUTOMATION IN MANUFACTURING		L	T	P	C
21A030423			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:
- To introduce various strategies of automation in manufacturing.

COURSE OUTCOMES:
After completion of the course, the student will be able to

CO1: Explain automation strategies and transport mechanisms in automated flow lines. **(K2)**
CO2: Analyze the automated flow lines with and without buffer storage. **(K4)**
CO3: Choose appropriate material handling system for a given application. **(K3)**
CO4: Explain the principles of as/rs and carousel storage systems. **(K2)**
CO5: Describe the aco and acc strategies to reduce the machine time and demonstrate the automated inspection methods. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	1	-	-	-	-	2	2	-	-
CO2	2	1	2	-	-	-	-	-	-	-	1	2	-	-
CO3	2	-	1	-	-	-	-	-	-	-	1	2	-	-
CO4	3	-	1	-	-	-	-	-	-	-	1	2	-	-
CO5	3	-	2	-	-	2	2	-	-	-	2	2	-	-

UNIT – I (8 Hrs)

Introduction – Production system – Automation in Production System – Elements of automated system – Levels of automation - Types of Automation – Automation principles and strategies. Automated Flow Lines: Configurations of AFL - Methods of part transport - Transfer mechanism - Buffer storage – System design considerations

Learning Outcomes: At the end of this unit, students should be able to
- Get the knowledge about importance of Automation in manufacturing. (L1)
- Gain basic knowledge about part transferring mechanisms. (L2)

UNIT – II (7 Hrs)

Analysis of Automated Flow Lines: General terminology and analysis of transfer Lines without buffer storage – upper bound approach and lower bound approach - analysis of automated flow lines with buffer storage – analysis of two stage transfer line – analysis of more than two stages - partial automation – analysis – cost calculations.

Learning Outcomes: At the end of this unit, students should be able to
- Describe about the analysis of automated flow lines. (L2)
- Explain about different types of automated flow lines. (L2)

UNIT – III **(9 Hrs)**

Automated Material Handling: Introduction – Design considerations in material handling - Types of equipment - Material transport equipment – AGV's – Conveyors – Hoists and cranes - analysis of material transport systems – vehicle based systems – conveyor analysis.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about the automated material handling. (L4)
- Demonstrate about the AGV's, conveyors. (L3)

UNIT – IV **(10 Hrs)**

Automated Storage Systems: Automated storage and retrieval systems – Reasons for automating storage operations – Types of AS/RS – Applications of AS/RS – Carousel storage systems – Analysis of storage systems.

Learning Outcomes: At the end of this unit, students should be able to

- Define about the automated storage systems. (L2)
- Describe about the AS/RS systems. (L2)

UNIT – V **(11 Hrs)**

Adaptive Control Systems and Automated Inspection: Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in Machining operations.

Automated Inspection: Fundamentals of Inspection – Types of inspection-Off line and On-line inspection – Inspection procedure -CMM - Machine vision.

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate about the adaptive control systems. (L3)
- Explain about the automated inspection. (L2)

TEXTBOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing", Groover. M.P, Pearson Publications.
2. "CAD/CAM/CIM", P. Radhakrishnan & N.Subhrammanyan, Digital Design Publications.

REFERENCE BOOKS:

1. "Computer Control of Manufacturing Systems", Yoram Coren, Tata McGraw Hill.
2. "Automation", W. Buekinsham, PHI Publications, 3rd Edition, 2004.

Course Code	CAD/CAM		L	T	P	C
21A030424			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To present the role of computers and technology that drives the modern industry.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply various transformations to manipulate a geometric model. **(K3)**
CO2: Illustrate various entities of wire frame, surface, and solid models. **(K3)**
CO3: Develop the CNC part programming for given component. **(K6)**
CO4: Formulate manufacturing cells based on similar attributes of parts, Justify the need of computer aided quality control. **(K6)**
CO5: Propose trends in manufacturing to improve the productivity. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3		3	-	3	-	-	-	3	-	-	-
CO2	2	2	3	1	3	-	3	--	-	-	3	-	-	-
CO3	2	2	3	2	3	-	3	-	-	-	3	-	-	-
CO4	2	2	3	2	3	-	3	-	-	--	3	-	-	-
CO5	2	2	3	2	3	-	3	-	-	-	3	-	-	-

UNIT – I (9 Hrs)

Introduction: Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD standards, CAD data structure, Data base management systems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, homogeneous transformations, clipping, hidden line / surface removal colour, shading.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of Automation, components of CAD/CAM, input and output components of CAD, Steps involved in computer aided design. (L2)

UNIT – II (8 Hrs)

Geometric Modeling: Representation techniques, Parametric and non parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations. Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry, analytical solid modeling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various requirements of information that are generated during geometric modelling stage, various types and its applications. (L2)
- Understand mathematical representations of curves used in geometric construction. (L2)

UNIT – III (10 Hrs)

Numerical control of Machines: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining centre, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Codes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the principle of NC, CNC, Machining Centre and various methods of part programming. (L3)

UNIT – IV (10 Hrs)

Group Technology: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits.

FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non optical, integration of CAQC with CAD and CIM.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the need of GT as a means of bringing the benefits of mass production to relatively smaller production. (L2)
- Understand the need of computers in process planning and QC (L2)
- Understand the definition and concept of FMS, and its elements. (L2)

UNIT – V (8 Hrs)

Computer Aided Processes Planning: Retrieval type and Generative type, benefits, Machinability data systems, Computer generated time standards.

Computer integrated production planning: Capacity planning, shop floor control, MRP-I, MRP-II, CIMS benefits. Trends in manufacturing systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Computer aided process planning, computer integrated production planning and the new trends in manufacturing. (L2)

TEXTBOOKS:

1. "CAD/CAM", A Zimmer & P. Groover, PE, PHI
2. "CAD/CAM - Principles and applications", P.N. Rao, TMH, 3rd Edition, 2010

REFERENCE BOOKS:

1. "Computer Aided Design & Manufacturing", Lalit Narayan, Mallikarjuna Rao, M. M. M. Sarcar, PHI, 2015
2. "Automation, Production systems & Computer integrated Manufacturing", P. E. Groover
3. "CAD/CAM/CIM", Radha Krishnan and Subramaniah, New Age, 3rd Edition, 2008
4. "Principles of Computer Aided Design and Manufacturing", Farid Amirouche, Pearson
5. "CAD/CAM Theory and Practice", R. Siva Subramaniam, TMH
6. "Computer Aided Design and Manufacturing", K. Lalit Narayan, PHI, 2008.
7. "Computer Aided Manufacturing", T.C. Chang, Pearson, 3rd Edition, 2008
8. "A text book of CAD/CAM", CSP Rao, Hitech Publ.

Course Code	HEAT TRANSFER LAB		L	T	P	C
21A030425			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To provide students with the necessary skills to conduct experiments on conduction and convection of heat; collect data, perform analysis and interpret results to draw valid conclusions through standard test procedures
- To determine thermal properties and performance of radiation heat transfer, heat exchanger, vapour compression refrigerator and air conditioner

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the basic principles of heat transfer to estimate the thermal conductivity of metals / nonmetals. **(K3)**

CO2: Analyze the performance of heat exchanger. **(K4)**

CO3: Evaluate fin effectiveness/efficiency. **(K5)**

CO4: Evaluate the Stefan Boltzmann constant upon using the fundamentals of radiation. **(K5)**

CO5: Apply the basic principles of heat transfer to analyze the heat transfer with phase change (boiling & condensation). **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	3	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-
CO5	-	-	-	3	-	-	-	-	3	3	-	-	-	-

LIST OF EXPERIMENTS: (Any 10 of the below experiments may performed)

1. Determination of Thermal Conductivity of insulating powder
2. Determination of Thermal Conductivity of Metal Bar
3. Determination of Effectiveness of a pin-fin
4. Determination of heat transfer coefficient in forced convection
5. Determination of heat transfer coefficient in natural convection
6. Determination of Emissivity of a test plate
7. Determination of Stefan Boltzmann constant
8. Determination of LMDT and Effectiveness Parallel flow Counter flow heat Exchanger
9. Determination of Critical Heat Flux.
10. Determination of Overall Heat Transfer Coefficient of a Composite wall
11. Determination of Thermal Conductivity of Liquid.
12. Performance Test on Vapour Compression Refrigeration
13. Performance Test on an Air Conditioner

TEXTBOOKS:

1. "Heat Transfer Laboratory", Mukund H. Divakar, Pendram International Publishing.

REFERENCE BOOKS:

1. "Heat Transfer: A Laboratory Manual", N. S. Srinivas.

Course Code	ADVANCED MACHINING LAB		L	T	P	C
21A030426			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To import practical exposure to the EDM, CNC lathe, CNC milling etc.
- To conduct experiments and understand the working of the same.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Ability to perform machining operation on EDM machine. **(K4)**
CO2: Ability to perform different Operation on CNC lathe machine. **(K4)**
CO3: Ability to perform different Operation on CNC milling machine. **(K4)**
CO4: Ability to perform different Operation on modern manufacturing method. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	-	3	1	-	-	-	-	-	-	-	-
CO2	2	3	-	-	3	1	-	-	-	-	-	-	-	-
CO3	2	3	-	-	3	1	-	-	-	-	-	-	-	-
CO4	2	3	-	-	3	1	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS:

1. To perform metal removing operation using EDM machine.
2. To perform Step turning operation on CNC lathe machine.
3. To perform Taper turning operation on CNC lathe machine.
4. To perform Threading operation on CNC lathe machine.
5. To perform drilling operation on CNC milling machine.
6. To perform Peck drilling operation on CNC milling machine.
7. To perform the engraving operation on CNC milling machine.
8. To perform the end milling operation on CNC milling machine.
9. To study the tool vibration using LDVT.
10. To perform surface finish operation on surface grinding machine.
11. To develop different components using 3D printing.

TEXTBOOKS:

1. “CNC Fundamentals & Programming”, P. M. Agarwal, Charotar Publications.

REFERENCE BOOKS:

1. “CNC Machines & Automation”, J. S. Narang, Dhanpat Rai & Co.

Course Code	MECHATRONICS AND MEASUREMENTS LAB		L	T	P	C
21A030427			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To make the students to learn about the Basic electronics, electrical and mechanical components used to control the machines and industries.
- Various types of sensors, signal conditioning systems and various pneumatic and hydraulic components used in control systems.
- Measurement of linear and angular dimensions.
- Measurement of pressure, flow, speed, displacement and temperature.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Study of sensors, Hydraulic and Pneumatic actuators and experimentation of its characterization for industrial applications. **(K1)**

CO2: Integrate all the hydraulic, pneumatic and electro pneumatic circuits by using simulation Software. **(K4)**

CO3: Analyze the measurement data obtained from different measuring instruments for the same physical quantity. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	2	3	-	-	-	-	-	1	-	-	-	-
CO2	1	-	2	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-

LIST OF EXPERIMENTS:

1. Study of hydraulic, pneumatic and electro-pneumatic circuits.
2. Modeling and analysis of basic hydraulic& Pneumatic circuits using Software.
3. Modeling and analysis of basic electrical circuits using Software.
4. Calibration of transducer or thermocouple for temperature measurement.
5. Study and calibration of LVDT transducer for displacement measurement.
6. Study and calibration of capacitive transducer for angular measurement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.

TEXTBOOKS:

1. "Mechanical Measurements", R. K. Rajput, S. Chand & Co..

REFERENCE BOOKS:

1. "Instrumentation and Mechanical Measurements", A. K. Tayal, Galgotia Publications.

Course Code	3D MODELLING USING CREO		L	T	P	C
21A030703			1	0	2	2
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To help product designers and engineers in developing a product design virtually.
- To sketch, model, validate and visualize the product design.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the complete details of 2-D sketch modelling tools such as lines, circles, rectangle etc. **(K1)**

CO2: Create and design 3-D models and shapes using various commands like extrude, sweep, blend and many more. **(K6)**

CO3: Create complex shapes using surface modelling feature. **(K6)**

CO4: Create assembly, drawings and projections of parts and components. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	3	-	-	-	3	2	-	-	-	-
CO2	1	-	-	-	3	-	-	-	3	2	-	-	-	-
CO3	1	-	-	-	3	-	-	-	3	2	-	-	-	-
CO4	1	-	-	-	3	-	-	-	3	2	-	-	-	-

MODULE – I:

1. Introduction to PTC Creo Parametric 3.0
2. Creating Sketches in the Sketch Mode-I.
3. Creating Base Features.

MODULE – II:

1. Datum’s.
2. Options Aiding Construction of Parts.
3. Advanced modelling Tools.

MODULE – III:

1. Assembly modelling.
2. Generating, Editing and Modifying the Drawing Views.
3. Dimensioning the Drawing Views.
4. Other Drawing Options.

MODULE – IV:

1. Surface modelling.
2. Working with Sheet metal Components.

TEXTBOOKS:

1. "PRO/Engineer", Daid S. Kelley, Tata Mc Graw Hill publications

REFERENCE BOOKS:

1. "PRO/Engineer for Engineer and Designer", Gaurav Verma and Prof. Sham Tickoo, Dreamtech publications

Course Code	RESEARCH METHODOLOGY (Common to all branches)		L	T	P	C
21A000004			2	0	0	0
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know how to define a Research problem, select suitable design and experimental approach. **(K1)**
CO2: Formulate sampling design and various techniques implemented on data collection. **(K6)**
CO3: Correlate any two variables and find the solution using regression analysis. **(K4)**
CO4: Examine hypothesis testing procedure, Analyze the significance of variance and covariance. **(K4)**
CO5: Write a report on research work for seminars, conferences formats. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (6 Hrs)

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of research and its process. (L2)
- Explain various types of research. (L2)
- Explain the steps involved in research design. (L2)
- Understand the different research approaches. (L2)

UNIT – II (6 Hrs)

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement –

Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of sampling and sampling design. (L2)
- Explain various techniques in measurement and scaling. (L2)
- Understand various methods of data collection. (L2)
- Design survey questionnaires for different kinds of research. (L3)
- Analyze the questionnaires. (L4)

<u>UNIT – III</u> (6 Hrs)

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of correlation and regression. (L2)
- Compare and contrast correlation and regression. (L3)
- Explain various types of correlation. (L3)
- Apply the knowledge of C&R Analysis to get the results. (L3)

<u>UNIT – IV</u> (6 Hrs)

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Understand the hypothesis testing procedure. (L2)
- Compare and contrast Parametric and Non-parametric Tests. (L3)
- Understand the use of chi-square test in investigating the distribution of categorical variables. (L2)
- Analyze the significance of variance and covariance. (L4)

<u>UNIT – V</u> (6 Hrs)

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how to write a report and research paper. (L2)
- Explain various techniques of interpretation. (L2)

- Understand the importance of professional ethics in research. (L2)
- Design a scientific paper to present in the conferences/seminars. (L3)

TEXTBOOKS:

1. "Research Methodology: Methods and Techniques", C.R.Kothari, New Age International Publishers, 2nd Edition,.
2. "Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, Sage Publications

REFERENCE BOOKS:

1. "Research Methodology and Statistical Tools", P. Narayana Reddy and G. V. R. K. Acharyulu, Excel Books, New Delhi, 1st Edition.
2. "Business Research Methods", Donald R. Cooper & Pamela S Schindler, 9th Edition.
3. "Fundamentals of Statistics", S C Gupta, Himalaya Publications, 7th Edition

Course Code	REFRIGERATION AND AIR CONDITIONING		L	T	P	C
21A030428			3	0	0	3
Pre-requisite	Applied Thermodynamics	Semester	VII			

COURSE OBJECTIVES:

- To introduce the basic cycles of various refrigerating systems, their performance evaluation along with details of system components and refrigerant properties.
- To impart knowledge of psychometric properties processes which are used in air-conditioning systems for comfort and industrial applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the working of air refrigeration cycle and its application in aircrafts. **(K1)**
CO2: Analyze the working of VCR system and their components. **(K4)**
CO3: Analyze the working of VAR, steam jet refrigeration systems. **(K4)**
CO4: Estimate the psychometric properties and analyze the psychometric processes. **(K2)**
CO5: Calculate the load acting on an air-conditioning system and select the appropriate process and equipment for the required comfort and industrial air-conditioning. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO2	3	2	1	2	3	-	-	-	-	-	-	-	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction: Need and Applications of refrigeration, Unit of refrigeration and C.O.P, Methods of refrigeration, Ideal and actual cycles of refrigeration.

Air Refrigeration: Bell Coleman cycle, Open and Dense air systems, Actual air refrigeration system. Refrigeration needs of Aircrafts - Air craft refrigeration systems - working and their analysis

Refrigerants: Desirable properties, classification, Nomenclature, Ozone Depletion, Global Warming.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the terminologies associated with refrigeration. (L2)
- Describe the Methods of refrigeration, Ideal and actual cycles of refrigeration. (L2)
- Demonstrate the bell-coleman cycle in air refrigeration. (L2)
- Identify the various refrigeration cycles. (L2)
- Classify various refrigerants used in vapour compression refrigeration systems. (L1)

UNIT – II (9 Hrs)

Vapour Compression Refrigeration: Working principle and essential components of the plant, actual cycle, effect of sub-cooling, super-heating, evaporator and condenser pressures on system performance – use of p-h charts.

System Components: Classification and working of Compressors, Condensers, Evaporators, Expansion devices – Types – working Principles.

Learning Outcomes: At the end of this unit, students should be able to

- Appraise the importance of vapour compression refrigeration system. (L5)
- Draw the T-S and P-H charts for representation of cycle. (L1)
- Model the numerical problems on refrigeration cycles. (L3)
- Demonstrate the influence of various parameters on system performance. (L2)

UNIT – III (10 Hrs)

Vapour Absorption System: Description and working of NH_3 – water system, Calculation of maximum COP and Description and working of Li Br –water (Two shell & Four shell) System, principle of operation three fluid absorption system, salient features.

Steam Jet Refrigeration System: Working Principle and basic components and its analysis

Non-conventional Refrigeration system: Thermoelectric refrigerator

Learning Outcomes: At the end of this unit, students should be able to

- Appraise the importance of vapour absorption refrigeration system. (L5)
- Illustrate the working of various components of steam jet refrigeration system. (L2)
- Estimate the motive steam required for steam jet refrigeration system. (L6)
- Describe the working principle of thermo- electric refrigerator. (L2)

UNIT – IV (8 Hrs)

Introduction to Air Conditioning: Psychometric Properties & Processes - Characterization of Sensible and Latent Heat Loads -- Need For Ventilation, Consideration of Infiltrated Air - Heat Load Concepts.

Air Conditioning Systems: Air Cooler (Evaporative Cooling), Window, Split, summer, winter, Year Round, Central Air Conditioning Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the psychometric properties & processes**.** (L2)
- Select the air conditioning systems for different realistic situations. (L6)
- Define the terms sensible heat load and latent heat load. (L1)
- Draw the psychometric charts for various air conditioning environments. (L1)

UNIT – V (9 Hrs)
Air Conditioning Equipment - Humidifiers - Dehumidifiers - Air Filters, Fans and Blowers.
HUMAN COMFORT: Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart. Heat Pump - Heat Sources - Different Heat Pump Circuits.
Learning Outcomes: At the end of this unit, students should be able to

- Appraise the importance of humidifiers and dehumidifiers. (L5)
- Select the requirements of temperature and humidity for human comfort. (L6)
- Demonstrate the heat pump working and its components. (L2)
- List the various air conditioning equipment's. (L1)

TEXTBOOKS:

1. "Refrigeration and Air Conditioning", C P Arora, Tata McGraw-Hill Education, 3rd Edition.
2. "A Course in Refrigeration and Air conditioning", SC Arora & Domkundwar, Dhanpat Rai publications, 5th Edition.
3. "Refrigeration and Conditioning", Manohar Prasad, New Age publications, Revised 2nd Edition.

REFERENCE BOOKS:

1. "Principles of Refrigeration", Dossat, Pearson Education.
2. "Basic Refrigeration and Air-Conditioning", Anantha Narayanan, Tata McGraw-Hill Education, 4th Edition.
3. "Refrigeration and Air Conditioning", Pakirappa, Durga Publishing House, Hyderabad

Course Code	AUTOMOBILE ENGINEERING		L	T	P	C
21A030429			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- The students acquires sufficient knowledge to classify Engines, Chassis, Fuel Supply Systems, Cooling Methods, Lubrication Methods, Ignition Systems, Generating Systems, Suspension Systems, transmission system, steering mechanism and braking methods. The students get the working knowledge of assembly of various components of layout and of various electrical equipment of an automobile.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify different parts of automobile and explain the working of engine. **(K1)**
CO2: Explain the working of transmission system, gear box, propeller shaft. **(K2)**
CO3: Describe the working of steering system. **(K1)**
CO4: Describe the working of suspension, braking system. **(K1)**
CO5: Summarize the environmental implications of automobile emissions and electrical systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (10 Hrs)

Introduction: Components of a Four Wheeler Automobile – Chassis and Body – Power Unit – Power Transmission – Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive.

Types of Automobile Engines: Engine Construction, Turbo Charging and Super Charging – Oil Filters, Oil Pumps – Crank Case Ventilation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the function of each and every component of an automobile. (L2)
- Understand the use of turbo charging and super charging. (L2)

UNIT – II (10 Hrs)

Transmission System: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel

Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter.

Propeller Shaft: – Hotch – Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles.

Learning Outcomes: At the end of this unit, students should be able to

- Knowledge on each and every component of transmission system of automobile. (L3)

<u>UNIT – III</u> (8 Hrs)

Steering System: Steering Geometry – Camber, Castor, King Pin Rake, Combined Angle Toe-In, Center Point Steering. Types Of Steering Mechanism – Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears – Types, Steering Linkages.

Learning Outcomes: At the end of this unit, students should be able to

- Understand purpose and methods of steering systems and their applications. (L2)

<u>UNIT – IV</u> (8 Hrs)

Suspension System: Objects of Suspension Systems – Rigid Axle Suspension System, Torsion Bar, Shock Absorber, Independent Suspension System.

Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the suspension system and braking system of an automobile. (L2)

<u>UNIT – V</u> (9 Hrs)

Emissions from Automobiles – Pollution Standards National and International – Pollution Control– Techniques – Multipoint Fuel Injection for SI Engines- Common Rail Diesel Injection, Emissions from Alternative Energy Sources– Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits.

Electrical System: Charging Circuit, Generator, Current – Voltage Regulator – Starting System, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Temperature Indicator.

Learning Outcomes: At the end of this unit, students should be able to

- Grasp the knowledge on emission standards, emission control techniques and electrical systems. (L4)

<u>TEXTBOOKS:</u>

1. “Automotive Mechanics – Vol. 1 & Vol. 2”, Kirpal Singh, Standard Publishers Distributors, 13th Edition, 2013.
2. “Automobile Engineering”, William Crouse, TMH, 10th Edition, 2006.

REFERENCE BOOKS:

1. "Automobile Engineering, R. K. Rajput, Laxmi Pub, 1st Edition, 2013.
2. "Automobile Engineering", K. K. Ramalingam, Scitech Pub, 2nd Edition.
3. "Automotive engines", Newton, Steeds & Garret.

Course Code	NON CONVENTIONAL SOURCES OF ENERGY		L	T	P	C
21A030430			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To study various types of renewable sources of energy and techniques used in exploiting solar, wind, tidal, geothermal and direct sources of energy and bio-fuels.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know the significance of renewable energy sources. **(K2)**

CO2: Understand the principles of solar energy storage systems and its applications. **(K2)**

CO3: Understand the working principles of wind, biomass and geothermal energy conversion techniques. **(K2)**

CO4: Understand the working principles of ocean, tidal and wave energy techniques. **(K2)**

CO5: Know the functioning of direct energy conversion techniques. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	1	-	2	3	-	-	-	-	-	-	-
CO2	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO3	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO4	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO5	3	-	1	1	-	2	3	-	-	2	3	1	-	-

UNIT – I (9 Hrs)

Introduction: Energy Sources and their availability, Role and potential of renewable source.

Solar Radiation: Structure of the sun, the solar constant, sun-earth relationships, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, Numerical problems on solar radiation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand about solar radiation. (L2)
- Distinguish between flat plate and concentrated solar collectors. (L2)
- Know about thermal storage requirements. (L1)
- Know about measurement of solar radiation. (L2)

UNIT – II (8 Hrs)

Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar collectors- flat plate, concentric collectors. Solar Applications-solar heating/cooling technique, solar distillation, drying, photovoltaic energy conversion, solar central power tower concept and solar chimney.

Learning Outcomes: At the end of this unit, students should be able to

- Understand about solar energy storage. (L2)
- Know about thermal storage requirements. (L2)
- Know about different applications of solar energy. (L2)
- Know about the PV cells. (L2)

UNIT – III (10 Hrs)

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, Betz criteria.

Bio-Mass Energy: Biomass Energy Sources, methods for obtaining energy from biomass, Biomass gasification.

Geothermal Energy: Resources, types of wells, methods of harnessing the energy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basics of wind energy conversion and system. (L2)
- Distinguish between VAWT and HAWT systems. (L1)
- Analyze the operation of bio mass energy. (L2)
- Know about geothermal energy. (L2)

UNIT – IV (9 Hrs)

Ocean Energy: Requirements of OTEC, classifications of OTEC, Environmental impacts of OTEC.

Tidal and wave energy: Potential and conversion techniques, Mini-hydel power plants and their economics.

Learning Outcomes: At the end of this unit, students should be able to

- To know about the ocean energy. (L1)
- Analyze the operation of tidal energy. (L4)
- Analyze the operation of wave energy. (L4)
- Analyze about the potential and conversion technique. (L4)

UNIT – V (9 Hrs)

Direct Energy Conversion: Need for DEC, limitations, principles of DEC. Thermo electric Power – See-beck, Peltier, joule, Thomson effects, Thermo-electric Power generators, and applications.

Fuel cells: Principles, faraday's law's, selection of fuels and operating conditions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the need and principle of DEC. (L2)
- Understand the principle, working and performance of fuel cell technology. (L2)

TEXTBOOKS:

1. "Renewable energy resources", Tiwari and Ghosal, Narosa.
2. "Non-Conventional Energy Sources", G.D. Rai, Dhanpat Rai and Sons.

REFERENCE BOOKS:

1. "Renewable Energy Sources", Twidell & Weir
2. "Solar Energy", Sukhatme, Tata McGraw-Hill Education.
3. "Solar Power Engineering", B. S. Magal, Frank Kreith & J. F. Kreith
4. "Principles of Solar Energy", Frank Krieth & John F Kreider

Course Code	POWER PLANT ENGINEERING		L	T	P	C
21A030431			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Familiarize the sources of energy, power plant economics and environmental aspects.
- Outline the working components of different power plant.
- Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations.
- Impart types of nuclear power plants, and outline working principle and advantages and hazards.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Outline sources of energy, power plant economics, and environmental aspects. **(K4)**
CO2: Explain power plant economics and environmental considerations. **(K2)**
CO3: Describe working components of a steam power plant. **(K1)**
CO4: Illustrate the working mechanism of diesel and gas turbine power plants. **(K3)**
CO5: Summarize types of renewable energy sources and their working principle. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	1	-	2	3	-	-	-	-	-	-	-
CO2	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO3	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO4	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO5	3	-	1	1	-	2	3	-	-	2	3	1	-	-

UNIT – I (10 Hrs)

Introduction to the Sources Of Energy - Resources and Development of Power in India. Convectional and non- conventional energy sources, Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection And Safety Regulations.

Learning Outcomes: At the end of this unit, students should be able to

- Outline sources of energy, compare and selection of types of power plants. (L2)
- Explain cost factors, load and power distribution factors. (L2)
- Select tariff based on load and demand factors. (L3)
- Summarize the impact of power plant on the environment, pollution mitigation and regulations. (L2)

UNIT – II (10 Hrs)

Steam Power Plant : Introduction to Boilers- Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process : Properties of Coal - Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate latest high pressure boilers, power plant cycles and their improvements.(L2)
- Explain various types of coals, coal handling operations and associated systems. (L2)
- Outline and compare types of feeders, stokers, combustion systems. (L2)
- Illustrate draught, dust collector, furnace, cooling tower and heat rejection systems. (L2)
- Evaluate pollution levels from power plants, pollution control methods, and application of pollution recorders. (L4)

UNIT – III (10 Hrs)

Diesel Power Plant: Diesel Power Plant, Construction, Plant lay out with auxiliaries, fuel storage.

GAS TURBINE PLANT: Introduction - Classification - Construction - Layout with Auxiliaries - Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principle of Gas turbine. (L2)
- Understand the open and close cycle Gas turbine with its auxiliaries. (L3)

UNIT – IV (8 Hrs)

Hydro Electric Power Plant: Water Power - Hydrological Cycle / Flow Measurement - Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways.

Hydro Projects and Plant: Classification - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

Learning Outcomes: At the end of this unit, students should be able to

- Explain hydrological cycle, infer flow measurements from hydrographs. (L2)
- Summarize working principle of hydro electric power plant. (L2)
- Illustrate typical layout of hydro electric power plant, and its auxiliary equipments. (L2)

UNIT - V (7 Hrs)

Power from Non-Conventional Sources: Utilization of Solar Collectors- Working Principle, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation. **Nuclear Power Station:** Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.

Types of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

Learning Outcomes: At the end of this unit, students should be able to

- Familiarize the source of conventional and non conventional sources in India. (L2)
- Explain working principle of Nuclear power plants, nuclear fuels, and reactor operations. (L2)
- Outline the various types of nuclear reactors, their applications and limitations. (L2)
- Summarize the hazards of nuclear reactors and significance of nuclear waste disposal. (L2)

TEXTBOOKS:

1. "Power Plant Engineering", P.K. Nag, TMH, 3rd Edition, 2013.
2. "Power plant technology", M. M. EI Wakil, TMH Publications.

REFERENCE BOOKS:

1. "A Text Book of Power Plant Engineering", Rajput, Laxmi Publications, 4th Edition, 2012.
2. "Power plant Engineering", Ramalingam, Scietech Publishers, 2013
3. "Power Plant Engineering", P.C. Sharma, S.K. Kataria Publications, 2012.
4. "A course in Power Plant Engineering", Arora and S.Domakundwar, Dhanpat Rai & Co Private Limited, 2014.

Course Code	COMPUTATIONAL FLUID DYNAMICS		L	T	P	C
21A030432			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To develop the equations describing fluid flow and numerical solutions to these equations.
- To understand different approaches employed for both time and spatial discretization and evaluate these approaches.
- To understand time accurate and steady-state methods, explicit and implicit techniques, laminar and turbulent flow, compressible and incompressible approaches, stability considerations, etc.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know introductory basic principles and approaches for solving FDM, FEM, FVD problems in different fields. **(K1)**

CO2: Discretise partial differential equations, governing flow equations which is the foundation for the finite difference method. **(K6)**

CO3: Calculate numerical errors that are generated, entails the conservations of mass, momentum and energy equations to the fluid flow along with Navier stokes equation. **(K3)**

CO4: Derive write the governing equation for fluid flow conditions. **(K4)**

CO5: Solve problems using different CFD techniques. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	1	-	2	3	-	-	-	-	-	-	-
CO2	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO3	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO4	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO5	3	-	1	1	-	2	3	-	-	2	3	1	-	-

UNIT – I (9 Hrs)

INTRODUCTION: Methods to solve a physical problem, numerical methods, brief comparison between FDM, FEM & FVM, applied numerical methods. Solution of a system of simultaneous linear algebraic equations, Iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for baned matrices. Finite difference applications in heat conduction and convention, heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate of the various kinds of numerical methods adopted. (L1)
- Illustrate various solutions for the numerical methods adopted in CFD. (L1)
- Solve problems using finite difference methods in conduction & convective heat transfer. (L3)

UNIT – II (9 Hrs)

FINITE DIFFERENCES: Discretization, consistency, stability, and fundamentals of fluid flow modelling. Introduction, elementary finite difference quotients, implementation aspects of finite -difference equations, consistency, explicit and implicit methods.

Learning Outcomes: At the end of this unit, students should be able to

- Formulate partial differential equations, including the governing flow equations which is the foundation for the finite difference method. (L3)

UNIT – III (9 Hrs)

ERRORS AND STABILITY ANALYSIS: introduction, first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the upwind scheme.

REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER: Introduction, Conservation of mass Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier stokes equations.

Learning Outcomes: At the end of this unit, students should be able to

- Solve and find the numerical errors that are generated and how the numerical calculations become unstable and also entails the conservations of mass, momentum and energy equations to the fluid flow along with Navier stokes equation. (L3)

UNIT – IV (9 Hrs)

STEADY FLOW: Dimensions form of momentum and energy equations, navier stokes equation, and conservative body force fields, stream function, vorticity formulation, boundary, layer theory, buoyancy, driven convection and stability.

Learning Outcomes: At the end of this unit, students should be able to

- Explains fundamental principles of fluid mechanics and formulate its governing differential equations and boundary conditions. (L3)

UNIT – V (9 Hrs)

SIMPLE CFD TECHNIQUES: Viscous flows conservation form space marching, relocation techniques, viscous flows, conservation from space marching relovation techniques, artificial viscosity, the alternating direction implicit techniques, pressure correction technique, computer graphic techniques used in CFD. Quasi one dimensional flow through a nozzle, turbulence models, standard and high Reynolds number models and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explains for numerical solutions for flow problems. These equations are applicable to time and space marching solutions especially parabolic hyperbolic and elliptic equations. (L2)

TEXTBOOKS:

1. "Computational Fluid Dynamics", J Chung, Cambridge University Press, 2nd Edition, 2010
2. "Computational Fluid Dynamics", John. D. Anderson, McGraw- Hill International Edition, India, 3rd Edition, 2010

REFERENCE BOOKS:

1. "Computational Fluid Mechanics and Heat Transfer", Ronnie Anderson, CRC Press, 3rd Edition, Special Indian Edition.
2. "Computational aerodynamics and fluid dynamics - An introduction", Jean-Jacques Chattot, Springer, Germany, 3rd Edition, 2010.
3. "Essential computational fluid Dynamics", Olegzikanov, Wiley India.
4. "Introduction to computational fluid dynamics", Pradip, Niyogi S.K. Chakraborty, M.K. Laha, Pearson.

Course Code	DESIGN & OPTIMIZATION OF THERMAL SYSTEMS		L	T	P	C
21A030433			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the basic concepts and methodologies of design and optimization of thermal systems.
- Formulate a design problem along with specifications, constraints, and limitations.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the importance of computers and software in the design, modelling, analysis, and optimization thermal systems. **(K2)**

CO2: Model different types of thermal systems and develop numerical models for the design and optimization of thermal systems. **(K5)**

CO3: Apply various numerical methods for the solution of various engineering problems. **(K3)**

CO4: Apply various optimization techniques for optimum design of thermal systems. **(K3)**

CO5: Apply various optimization techniques for optimum design of thermal systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3	-	-	-	-	-	-	-	-	-
CO2	3	2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Basic Considerations in Design Problem - Requirements and Specifications, Given quantities, Design Variables, Constraints or Limitations, Additional Considerations. Conceptual Design - Innovative conceptual Design, Selection from available concepts, Modifications in the design of Existing systems. Steps in the Design Process - Physical system, Modelling, Simulation, Evaluation. Computer-Aided Design - Main Features, Computer Aided Design of Thermal Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the variables, constraints for physical thermal systems. (L2)
- Modelling, simulation and derive the results. (L4)

UNIT – II (9 Hrs)

Modelling of Thermal Systems: Introduction - Importance of Modelling in Design, Basic features of Modelling. Types of Models - Analogue Models, Mathematical Models, Physical

Models, Numerical Models, Interaction between models, other classifications. Mathematical Modelling - General Procedure, Final Model and Validation. Physical Modelling and Dimensional Analysis - Dimensional Analysis, Overall Physical Model.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Modelling of Thermal Systems and types of models available. (L2)
- Explain the procedure to solve for physical model. (L3)

UNIT – III (10 Hrs)

Numerical Modelling and Simulation: Numerical Modelling - General Features, Development of a Numerical Model, Available Software. Solution Procedures - Linear Algebraic Systems, Nonlinear Algebraic Systems, Ordinary Differential Equations, Partial Differential Equations. Methods for Numerical Simulation - Steady Lumped Systems, Dynamic Simulation of Lumped Systems, Distributed Systems, Numerical Simulation Versus Real System.

Learning Outcomes: At the end of this unit, students should be able to

- Made numerical models using different mathematical techniques. (L5)
- Analyze different numerical simulation systems. (L4)

UNIT – IV (10 Hrs)

Problems Formulation for Optimization: Introduction - Optimization in Design, Final Optimized Design. Basic Concepts - Objective Function, constraints, Operating Conditions Versus Hardware, Mathematical Formulation. Optimization Methods - Calculus Methods, Search Methods, Linear and Dynamic Programming, geometric Programming, other Methods. Optimization of Thermal Systems - Different Types of Thermal Systems, Examples.

Learning Outcomes: At the end of this unit, students should be able to

- Formulate mathematical representation for optimization problems in different types thermal energy systems. (L3)
- Optimize the different thermal systems using different optimization methods. (L5)

UNIT – V (7 Hrs)

Lagrange Multipliers: Introduction to Calculus Methods, the Lagrange Multiplier Method - Basic Approach, Physical Interpretation, Significance of the Multipliers. Optimization of Unconstrained Problems - Use of Gradients for Optimization, Determination of Minimum or Maximum, Conversion of Constrained to Unconstrained Problem. Optimization of Constrained Problems. Applicability to Thermal Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Know the significance of the Lagrange multiplier. (L2)
- Solve the constrained and unconstrained problems. (L5)

TEXTBOOKS:

1. "Design and Optimization of Thermal Systems", Yogesh Jaluria, CRC Press, 2nd Edition.
2. "Design of Thermal Systems", W. G. Stoecker, McGraw Hill, 3rd Edition

REFERENCE BOOKS:

1. "Thermal Systems Design and Optimization", C. Balaji, Springer

Course Code	PRINCIPLES OF INDUSTRIAL ENGINEERING		L	T	P	C
21A030434			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To familiarize the learner with Industrial Engineering principles for enhancing productivity of the industrial systems.
- To impart knowledge of principles and techniques of Project Management, Quality Control, Operations Management and Inventory control to the learner.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Define and understand the concept of industrial engineering and productivity. **(K1)**
CO2: Understand the importance of plant location, layout and materials management. **(K2)**
CO3: Describe the implementation of motion and time study concepts at a work place. **(K1)**
CO4: Explain the statistical quality control techniques – control charts, OC curves. **(K2)**
CO5: Apply the techniques CPM, PERT, crashing in project management. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	1	-	1	-	-	-	-
CO2	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	3	-	-	3	-	1	-	-	-	-	-	-
CO4	3	-	-	-	-	3	-	2	-	-	-	-	-	-
CO5	2	-	-	2	-	3	-	2	-	-	-	-	-	-

UNIT – I (8 Hrs)

Introduction to Industrial Engineering: History and Development, Industrial Engineering contributions, activities, objectives, techniques, function of industrial engineer, productivity-definition, expectation, benefits, measures, productivity improvement techniques.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the industrial engineering concepts and productivity concepts and techniques. (L2)

UNIT – II (10 Hrs)

Plant Layout and Materials Management: Plant location and its importance. Factors influencing Plant Location, Techniques of Plant Location –Plant Layout, Principles of Scientific Layout, Types of Plant Layout, Techniques of Plant Layout –Flow Patterns, Materials Management, Objectives, Inventory, Types of Inventory, Inventory Control and its techniques – EOQ, Selective Control Analysis, Simple EOQ Model, EOQ model under fluctuating Demand. Numerical problems on EOQ, Reorder Level, number of orders.

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of plant location, plant layout in industries, also the materials management, inventory control model. (L2)

<u>UNIT – III</u> (9 Hrs)

Work Study – Importance – Method Study – Objectives, Procedure, Recording Techniques, Motion Study – Objectives, Procedure, SimoChart, Memo Motion Study, Principles of Motion Economy, Work Measurement – Objectives – Techniques of Work Measurement, Procedure of Stop Watch Study, Work Measurement Techniques, Computation of standard time.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Role of work study and how to conduct method study and work measurement in industries. (L2)

<u>UNIT – IV</u> (10 Hrs)

Statistical Quality Control (SQC): Inspection, Quality Control, Significance of Quality Control, Statistical Quality Control, Causes of variation, Control Charts – Significance, Control Charts for variables, Control Charts for attributes, Process capability, numerical problem on X Bar-R Charts, X Bar-S Charts, C-Charts, p-Charts, np-Chart, Interpretation of Control Charts. Acceptance Sampling – Types of Acceptance Sampling – OC Curves.

Learning Outcomes: At the end of this unit, students should be able to

- Know the significance of statistical quality control, Interpretation of Control Charts Bar-R Charts, X Bar-S Charts, C-Charts. (L2)

<u>UNIT – V</u> (8 Hrs)

Project Management: Project Management – Importance, Network Techniques – CPM, PERT, Terminology, Network Rules, Determination of EST, LST, EFT, LFT, Floats, Slack, Standard Deviation, Variance, Probability of completion of the project. Direct and Indirect Costs of the Project, Cost Slope, Crashing procedure, Determination of optimum duration and optimum cost of the project.

Learning Outcomes: At the end of this unit, students should be able to

- Draw CPM, PERT network diagrams and how to use them in monitoring projects. (L4)

<u>TEXTBOOKS:</u>

1. "Industrial Engineering & Management Science", T.R Banga N.K Agarwal, S.C Sharma, Khanna Publications
2. "Industrial Engineering & Management", O. P. Kanna, Dhanpat Rai Publications.
3. "Operations Management", Joseph G. Monks, Tata McGraw Hill.

REFERENCE BOOKS:

1. "Industrial Engineering & Management", N.V.S. Raju, Cengage Learning.
2. "Introduction to work study", Ilo, 4th Revised Edition, 1992.
3. "Project management- A managerial approach", Jack R. Meredith, Samuel J. Mantel, Wiley India Pvt. Ltd.
4. "Modern production management", Elwood S.Buffa and Rakesh K.Sani, John Wiley & Sons Inc.
5. "PERT and CPM Principles and Applications", L.S. Srinath, Affiliated East- West Press (Pvt.) Ltd.
6. "Industrial Engineering &Production Management", M. Mahajan, Dhanpat Rai &co.

Course Code	PRODUCTION AND OPERATION MANAGEMENT		L	T	P	C
21A030435			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Introduction to the technical design and manufacturing operations and supply management to the sustainability of an enterprise.
- Need for forecasting and types of forecasting.
- Import the basic principles of project management and other business functions such as value engineering, purchasing, marketing, finance etc.
- Analyze the new demands of the globally competitive business environment that supply chain managers face today.
- Knowledge on various scheduling algorithms applicable to single machine, parallel machines, flow shop and job shop models.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the operations and production management to the sustainability of an Enterprise. **(K3)**

CO2: Identify the need for forecasting and understand different forecasting methods. **(K2)**

CO3: Understand the significance of value engineering and plant layout. **(K2)**

CO4: Apply the aggregate planning, material requirement planning, JIT in manufacturing. **(K3)**

CO5: Design, analyze and implement single machine, parallel machine, flow shop and job shop scheduling algorithms. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	1	-	2	3	-	-	-	-	-	-	-
CO2	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO3	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO4	3	-	1	1	-	2	3	-	-	2	3	1	-	-
CO5	3	-	1	1	-	2	3	-	-	2	3	1	-	-

UNIT – I (8 Hrs)

Introduction: Operations Management – Definition, Objectives, Types of Production System, Difference between OM & PM, Historical Development of Operations Management, Current Issues in Operation Management, Product Design – Requirements of Good Product Design, Product Development – Approaches, Concepts in Product Development, Standardization, Simplification, Speed to Market, Introduction to Concurrent Engineering.

Learning Outcomes: At the end of this unit, students should be able to

- Understand production and operations management and its functions, productivity and measurement, design of goods and services and aggregative planning. (L2)

UNIT – II (7 Hrs)

Forecasting: Introduction, Statistical Forecasting Techniques, Moving Average, Exponential Smoothing Technique, Errors in Forecasting and Evaluation of Forecasting Techniques.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of forecasting, uses of long term and short term forecasting and application of qualitative and quantitative methods for finding the future demands. (L2)

UNIT – III (10 Hrs)

Value Engineering and Plant Layout: Value Engineering – Objectives, Types of Values, Function and Cost, Product Life Cycle, Steps in Value Engineering, Methodology in Value Engineering, FAST Diagram and Matrix Method. Facility Location and Layout – Factor Considerations in Plant Location, Comparative Study of Rural and Urban Sites, Methods of Selection of Plant Layout, Objectives of Good layout, Principles, Types of Layout, Line Balancing

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of value engineering and its applications. (L2)
- Understand the plant location based on facilities available and what are the important factors affecting the facilities location of a plant, and plant layout. (L2)
- Understand plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time. Can compare the rural & urban sites, methods of selection. (L2)

UNIT – IV (11 Hrs)

Aggregate Planning and MRP: Aggregate Planning – Definition, Different Strategies, Various Models of Aggregate Planning- Transportation and Graphical Models, Master scheduling, Material Requirement Planning(MRP)- Terminology, Types of Demands, Inputs to MRP, Techniques of MRP, Lot Sizing Methods, Benefits and Drawbacks of MRP, Manufacturing Resources Planning (MRP II), Just in Time (JIT) Philosophy, Kanban System, Calculation of Number of Kanbans, Pull Systems vs. Push Systems, Requirements for Implementation of JIT, JIT Production Process, Benefits of JIT.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Aggregate Planning strategies, MRP, JIT and kanban system. (L2)

UNIT – V (9 Hrs)

Scheduling: Policies, Types of Scheduling, Scheduling Strategies, Scheduling and Loading Guidelines, Forward and Backward Scheduling, Grant Charts, Priority Decision Rules, Flow Shop Scheduling, Job Shop Scheduling, Line of Balance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the scheduling concepts and strategies, difference between flow shop and job shop scheduling and line of balance. (L2)

TEXTBOOKS:

1. "Modern Production - Operations Management", Buffa E.S. and Sarin R.K., Wiley India Pvt. Ltd., New Delhi, 8th Edition, 2009.
2. "Operations Management-Theory and Problems", Joseph G. Monks, McGraw Hill Education, 3rd Edition, 1987

REFERENCE BOOKS:

1. "Production Systems: Planning, Analysis and Control", James L. Riggs, Jim Rigs, Wave Land Press, 4th Edition, 1992.
2. "Production and Operations Management", Chary S.N., McGraw Hill Education, 5th Edition, 2017.
3. "Operations and Supply Chain Management", Richard B. Chase, Ravi Shankar, Robert Jacobs F., McGraw Hill Education, 15th Edition, 2018.
4. "Production and Operations Management", Pannerselvam R., PHI Learning Pvt. Ltd., New Delhi, 3rd Edition, 2012.
5. "Production and Operation Analysis: Strategy – Quality – Analytics – Applications", Steven Nahmias, Tava Lennon Olsen, Waveland Press Inc., 7th Edition, 2015.

ONLINE LEARNING RESOURCES:

1. https://www.vssut.ac.in/lecture_notes/lecture1429900757.pdf
2. https://lecturenotes.in/subject/100/production-and-operation-management
3. https://www.studocu.com/in/document/guru-gobind-singh-indraprastha-university/production-operations-management/full-UNIT - I-lecture-notes-6/3528988
4. https://mrcet.com/downloads/digital_notes/ME/III%20year/POM%20NOTES.pdf
5. https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_OM_NOTES.pdf
6. https://nptel.ac.in/courses/112107238
7. https://nptel.ac.in/courses/110107141

Course Code	TOTAL QUALITY MANAGEMENT		L	T	P	C
21A030436			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concept of quality, cost of quality, international quality standards.
- To learn the principles of Total quality management, techniques for problem solving.
- To learn about various tools of quality management used in various industrial applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts of Quality and Quality Control Techniques. **(K2)**
CO2: Understand TQM concepts and History and use quality tools for problem solving. **(K2)**
CO3: Use TQM techniques and to formulate quality circles to find solutions with team work. **(K3)**
CO4: Apply various TQM Methods to solve problems in industry. **(K3)**
CO5: Analyze various quality problems and contribute towards continuous improvement in the system. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	2	-	2	2	2	-	2	-	-	-	2	-	-
CO5	1	-	-	-	-	2	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Inspection & Quality Control: Statistical Quality Control (SQC) – Techniques - variables and attributes Control charts: $\overline{X}$ - R Charts, P-Chart, C-Chart. Acceptance Sampling – Single and Double sampling Plan - OC Curves. BIS and ISO Standards – Importance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Control charts: $\overline{X}$ - R Charts, P-Chart, C-Chart, single and double sampling plans and BIS & ISO standards. (L1)

UNIT – II (8 Hrs)

TQM – concepts, History - Quality management philosophies - Juran, Deming, Crosby, Feigenbaum, Ishikawa – Stages of Evolution – continuous improvement – internal and external customers - TQM tools & techniques - 7 QC tools - 7 New QC tools.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various quality management philosophies, Evaluation of TQM, TQM tools and technologies. (L1)

UNIT – III (10 Hrs)

Problem solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis, Quality circles – organization – team approach.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse Problem solving process, system failure analysis, fault tree analysis, pedigree analysis and concept Quality circles. (L4)

UNIT – IV (10 Hrs)

Quality Function Development (QFD) – elements of QFD –benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Know the procedure for quality function development, bench marking, taguchi analysis. (L1)

UNIT – V (8 Hrs)

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management, Six sigma approach – application of six sigma approach to various industrial situations.

Learning Outcomes: At the end of this unit, students should be able to

- Know the value improvement, supplier teaming and the concept of business process re-engineering, supply chain management and six sigma. (L1)

TEXTBOOKS:

1. “Total Quality Management”, D. R. Kiran, BS Publications, 2016
2. “Total Quality Management”, Bester field, Pearson.

REFERENCE BOOKS:

1. “Quality management”, Howard Giltow, TMH
2. “Quality management”, Evans.
3. “Quality management”, Bedi
4. “Total Quality Management”, Joseph & Susan Berg
5. “Total Quality Management - Toward the Emerging Paradigm”, Bounds, Yorks, Adams, Ranney, McGraHill, 1994

Course Code	MANAGEMENT SCIENCE (Common to all Branches)		L	T	P	C
21A110204			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training& Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concepts and principles of management in real life industry to design and develop organization chart and structure for an enterprise. **(K3)**

CO2: Apply operations management techniques in real life industry. **(K3)**

CO3: Apply the concepts of HRM in Recruitment, Selection, Training & Development. **(K3)**

CO4: Develop PERT/CPM charts for projects of an enterprise and estimate time & cost of a project and to develop Mission, Objectives, Goals & Strategies for an enterprise in dynamic environment. **(K3)**

CO5: Understand & apply modern management techniques wherever possible. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	3	-	-	-

UNIT – I (9 Hrs)

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of management and organization (L2)
- Apply the concepts & principles of management in real life industry (L3)
- Analyze the organization chart & structure for an enterprise.(L4)
- Evaluate and interpret the theories and the modern organization theory (L5)

UNIT – II (10 Hrs)

Operations Management: Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the core concepts of Management Science and Operations Management (L2)
- Apply the knowledge of Quality Control, Work-study principles in real life industry (L3)
- Evaluate Materials departments & Determine EOQ (L5)
- Analyze Marketing Mix Strategies for an enterprise (L4)
- Create and design advertising and sales promotion (L5)

UNIT – III (6 Hrs)

HUMAN RESOURCES MANAGEMENT: HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development (L2)
- Apply Managerial and Operative Functions (L3)
- Analyze the need of training (L4)
- Evaluate performance appraisal (L5)
- Design the basic structure of salaries and wages (L5)

UNIT – IV (12 Hrs)

Strategic & Project Management: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

Learning Outcomes: At the end of this unit, students should be able to

- Understand Mission, Objectives, Goals & Strategies for an enterprise (L2)
- Apply SWOT Analysis to strengthen the project (L3)
- Analyze Strategy formulation and implementation (L4)
- Evaluate PERT and CPM Techniques (L5)
- Create in competing the projects within given time (L5)

UNIT – V (8 Hrs)

Contemporary Issues in Management: The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand modern management techniques (L2)
- Apply Knowledge in modern management (L3)
- Analyze CRM, TQM (L4)
- Evaluate Six Sigma concept and SCM (L5)

TEXTBOOKS:

1. “Management Science”, A.R Aryasri, TMH, 2013
2. “Management”, Stoner, Freeman, Gilbert, Pearson Education, New Delhi, 2012.

REFERENCE BOOKS:

1. “Essentials of Management”, Koontz &Weihrich, TMH, 6th Edition, 2005.
2. “Management Principles and Guidelines”, Thomas N. Duening & John M. Ivancevich, Biztantra.
3. “Production and Operations Management”, Kanishka Bedi, Oxford University Press, 2004.
4. “Modern Management”, Samuel C. Certo, 9th Edition, PHI, 2005

Course Code	SIMULATION LAB		L	T	P	C
21A030704			1	0	2	2
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To impart the fundamental knowledge on using various analytical tools like ANSYS, FLUENT, etc., for Engineering Simulation.
- To know various fields of engineering where these tools can be effectively used to improve the output of a product.
- To impart knowledge on how these tools are used in Industries by solving some real time problems using these tools.

COURSE OUTCOMES:

After completion of the course, the student will be able to,

CO1: Create model using any modelling software such as catia, proE, Ansys. **(K4)**

CO2: Analyze the stress distribution, maximum deformation and frequencies using static, modal and harmonic analysis. **(K4)**

CO3: Analyze the temperature distribution in one dimensional heat transfer problems. **(K4)**

CO4: Analyze the temperature distribution in two-dimensional heat transfer problems. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	2	2	-	-	-	-
CO2	-	-	2	-	2	-	-	-	-	2	-	-	-	-
CO4	3	3	-	-	3	-	-	-	-	-	-	-	-	-
CO5	-	-	3	-	1	2	-	-	-	-	-	-	-	-

I. Modeling

1. Surface modeling.
2. Solid modeling.
3. Drafting.
4. Assembling.

II. Structural Analysis using any FEA Package for different structures that can be discretized with, 2-D & 3-D elements

1. Static Analysis.
2. Modal Analysis.
3. Harmonic Analysis.

III. Thermal Analysis using any FEA Package for different structures that can be discretized with 1-D, 2-D & 3-D elements

1. Steady state thermal analysis.
2. Transient thermal analysis.

TEXTBOOKS:

1. "PRO/Engineer for Engineers and Designers", Gaurav Verma and Prof. Sham Tickoo, Dreamtech Publications

REFERENCE BOOKS:

1. "Ansys Workbench for Engineers and Designers", Sham Tickoo, Dreamtech Publications
2. "Finite Element Simulation with Ansys workbench", Huei-Huang Lee, SDC Publications.

OPEN ELECTIVE – I

Course Code	AIR POLLUTION AND CONTROL		L	T	P	C
21A010501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To identify the sources of air pollution
- To know the composition and structure of atmosphere
- To know the pollutants dispersion models
- To understand the working of air pollution control equipment
- To identify the sources of noise pollution and their controlling methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the sources of air pollution. **(K2)**
CO2: Explain the composition and structure of atmosphere. **(K4)**
CO3: Discuss the general characteristics of stack emissions and their behavior. **(K2)**
CO4: Understand the mechanism of Control of air pollutants. **(K2)**
CO5: Know about the noise sources, mapping, prediction equations etc. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	-	-	-	3	1	-	-	-	-	3	1
CO2	3	1	3	-	-	-	3	1	-	-	-	-	1	1
CO3	3	2	2	-	-	-	3	1	-	-	-	-	2	2
CO4	3	1	2	-	-	-	3	1	-	-	-	-	1	1
CO5	3	2	2	-	-	-	3	1	-	-	-	-	1	2

UNIT – I (9 Hrs)

Introduction: sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance. Indoor Air Pollution– sources, effects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the character of atmospheric pollutants and their effect. (L4)

UNIT – II (9 Hrs)

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Wind rose diagram.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the composition and structure of atmosphere. (L4)
- Write the maximum mixing depth and windrose diagram. (L6)

UNIT – III (9 Hrs)

General characteristics of stack emissions, plume behavior, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources. Monitoring of particulate matter and gaseous pollutants –respirable, non-respirable and nano - particulate matter. CO, CO2, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

Learning Outcomes: At the end of this unit, students should be able to

- Express about the general characteristics of stack emissions and their behavior. (L6)
- Analyze the monitoring of particulate matter and gaseous pollutants. (L4)

UNIT – IV (9 Hrs)

Air Pollution Control equipment for particulate matter & gaseous pollutants– gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – Adsorption, Absorption, Scrubbers, Condensation and Combustion.

Learning Outcomes: At the end of this unit, student should be able to

- Explain the various air pollution control equipment. (L3)

UNIT – V (9 Hrs)

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the noise sources, mapping, prediction equations etc., (L5)

TEXTBOOKS:

1. “Air Pollution - Its Origin and Control”, Wark K., Warner C.F., and Davis W.T, Harper & Row Publishers, New York.
2. “Environmental Engineering”, H.S. Peavy, D.R. Row & G. Tchobanoglous, Mc Graw Hill International Edition

REFERENCE BOOKS:

1. “Air Pollution”, Perkins H.C., McGraw Hill.
2. “Air Pollution Control Theory”, Crawford M., TATA McGraw Hill.
3. “Air Pollution”, Stern A.C., Volume I, II, III.
4. “Air Pollution”, Seinfeld N.J., McGraw Hill.
5. “Air Quality Management”, Stern A.C., Volume V.
6. “Air Pollution”, M N Rao and HVN Rao, Tata McGraw Hill publication

ONLINE LEARNING RESOURCES:

1. http://www.epa.gov
2. http://www.indiaenvironmentportal.org.in
3. http://nptel.iitm.ac.in
4. http://www.filtersource.com

Course Code	ELECTRIC VEHICLES		L	T	P	C
21A020501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- Get exposed to EV system configuration and parameters
- Know about electro mobility and environmental issues of EVs
- Understand about basic EV propulsion and dynamics
- Understand about fuel cell technologies for EV and HEVs
- Know about basic battery charging and control strategies used in electric vehicles

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand and differentiate between conventional and latest trends in Electric vehicles. **(K2)**

CO2: Analyze various EV resources, EV dynamics and Battery charging. **(K4)**

CO3: Apply basic concepts of EV to design complete EV system. **(K3)**

CO4: Design EV system with various fundamental concepts. **(K5)**

CO5: Analyze the various control strategies used in battery charging in the electric vehicles. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to EV Systems and Parameters: Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic concepts of EV to design complete EV system. (L3)
- Explain EV system configuration. (L3)
- Understand various EV parameters. (L2)

UNIT – II (9 Hrs)

EV and Energy Sources: Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand electro mobility and environmental issues of EVs. (L2)
- Explain the history of Electric power trains. (L3)
- Compare conventional, battery, hybrid and fuel cell electric systems. (L3)

UNIT – III (9 Hrs)

EV Propulsion and Dynamics: Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi-motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of EV system. (L2)
- Choose a suitable electric propulsion system. (L2)
- Classify EV motors and their applications. (L3)

UNIT – IV (9 Hrs)

Fuel Cells: Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples.

Learning Outcomes: At the end of this unit, students should be able to

- FUEL CELLS: Explain the working principle of Fuel cells. (L3)
- Analyze fuel cell technologies for EV and HEVs. (L4)
- Compare series, series-parallel hybrid systems. (L3)

UNIT – V (9 Hrs)

Battery Charging and Control: Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modeling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic battery charging in Electric Vehicles. (L2)
- Analyze control strategies used in electric vehicles. (L4)

TEXTBOOKS:

1. "Modern Electric Vehicle Technology", C.C Chan, K.T Chau, Oxford University Press Inc., New York 2001.

2. "Electric Vehicle Technology Explained", James Larmenier, John Lowry, Wiley, 2003.

REFERENCE BOOKS:

1. "Electric and Hybrid Vehicles Design Fundamentals", Iqbal Husain, CRC Press 2005.
2. "Advanced Electric Drive Vehicles", Ali Emadi, CRC Press, 2015.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

Course Code	ELECTRICAL DISTRIBUTION SYSTEMS		L	T	P	C
21A020502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- The classification of distribution systems
- The aspects and design considerations in DC and AC distribution and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the various factors associated with power distribution. **(K3)**
CO2: Make voltage drop calculations in given distribution networks. **(K3)**
CO3: Learn principles of substation maintenance. **(K2)**
CO4: Compute power factor improvement for a given system and load. **(K3)**
CO5: Understand implementation of SCADA for distribution automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Load Modeling and Characteristics: Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural, and Industrial) and Their Characteristics.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic concepts of the electrical distribution systems. (L2)
- Analyze the relationship between load factor and loss factor. (L4)
- Understand the various loads and its characteristics. (L2)

UNIT – II (9 Hrs)

Classification Of Distribution Systems: Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the classification of electrical distribution systems. (L2)
- Analyze the design considerations of the radial and loop type feeders. (L4)

UNIT – III (9 Hrs)

Substations: Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar Sectionalized Single Bus Bar, With Relevant Diagrams.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the layout of the substation and various equipment installed. (L2)
- Analyze the classification of the substation based on insulating medium. (L4)
- Understand various bus bar schemes in substation. (L2)

UNIT – IV (9 Hrs)

Power Factor Improvement: Three Phase Balanced Primary Lines. Causes of Low P.F - Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

UNIT – V (9 Hrs)

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

TEXTBOOKS:

1. "Electric Power Distribution Engineering", Turan Gonen, CRC Press, 3rd Edition, 2014.
2. "Electric Power Distribution", A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

REFERENCE BOOKS:

1. "Electric Power Distribution Automation", Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010
2. "Electrical Power Distribution Systems", V. Kamaraju, Jain Book Depot, 2012.

Course Code	INTEGRATED CIRCUITS AND APPLICATIONS		L	T	P	C
21A040501			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To introduce the basic building blocks of linear integrated circuits.
- To impart knowledge on linear and non-linear applications of Op-Amps.
- To design various circuits using Op-Amps.
- To familiarize with specialized ICs such as 555 timer and voltage regulators.
- To familiarize with digital ICs.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the construction and characteristics of Operational Amplifier IC **(K2)**
CO2: Explain various linear & non-linear applications of Op-amp **(K2)**
CO3: Develop knowledge on filters and describe internal circuit operation of 555 timer and voltage regulators ICs **(K3)**
CO4: Summarize combinational circuits using Digital integrated circuits **(K3)**
CO5: Explain the internal structure of sequential Digital integrated circuits **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	3	1	-
CO2	2	2	2	1	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	1	-	-	-	-	-	-	-	3	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	1	-

UNIT – I (8 Hrs)

INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER: Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of IC & classifications (L2)
- Understand the concepts of Operational amplifier. (L2)
- Illustrate the internal circuit of operational amplifier (L2)
- Analyze DC & AC characteristics of op-amp (L4)

UNIT – II (10 Hrs)

LINEAR APPLICATIONS OF OP-AMP: Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveformgenerators, Oscillators

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of integrator & differentiator circuits (L2)
- Understand the concepts of multivibrators and waveform generators (L2)
- Develop the output voltage expression for instrumentation amplifier (L3)
- Analyze the adder, subtractors, multiplier and divider circuits (L4)

<u>UNIT – III</u> (10 Hrs)

ACTIVE FILTERS: Introduction, Butterworth filters – 1^{st} order, 2^{nd} order low pass and high pass filters, band pass, band reject and all pass filters.

TIMERS AND REGULATORS: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, Introduction-Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on 1st and 2nd order active filters. (L3)
- Understand the functionality of 555 timer. (L2)
- Understand the internal structure and functionality of voltage regulators (L2)

<u>UNIT – IV</u> (8 Hrs)

COMBINATIONAL CIRCUITS USING TTL 74XX ICS: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7- segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on the working of various combinational circuit ICs. (L3)
- Develop higher order combinational circuits from lower order Combinational ICs. (L3)

<u>UNIT – V</u> (9 Hrs)

SEQUENTIAL CIRCUITS USING TTL 74XX ICS: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493), Memory -SRAM & DRAM.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of sequential circuits using TTL ICs. (L2)
- Develop higher order Sequential circuits from lower order Sequential ICs. (L3)

TEXTBOOKS:

1. "Linear Integrated Circuit", D. Roy Choudhury, Shail B. Jain, New Age International Pvt.Ltd., New Delhi, India, 4th Edition, 2012
2. "OP-AMP and Linear Integrated Circuits", Ramakant A. Gayakwad, Prentice Hall / Pearson Education, New Delhi, 4th Edition, 2012
3. "Digital Fundamentals", Floyd, Jain, Pearson Education, New Delhi, 8th Edition, 2009.

REFERENCE BOOKS:

1. "Design with operational amplifiers and analog integrated circuits", Sergio Franco McGrawHill, New Delhi, 1997
2. "Digital Design Principles and Practices", John F Wakerly, Pearson Education, 4th Edition

Course Code	INTRODUCTION TO SIGNAL PROCESSING		L	T	P	C
21A040502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- To represent continuous time signals (both periodic and non-periodic) in the time domain, s-domain and the frequency domain.
- To understand the properties of analog filters, and have the ability to design Butterworth filters.
- To understand and apply sampling theorem and convert a signal from continuous time to discrete time and able to represent the discrete time signal in the frequency domain.
- To understand FIR and IIR filters to meet given specifications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain continuous time and discrete time signals and systems, in time and frequency domain. **(K3)**

CO2: Apply Fourier series and Fourier Transform to analyze periodic & non-periodic signals and their spectra. **(K3)**

CO3: Design and implement the analog filter using components/suitable simulation tools. **(K4)**

CO4: Apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time. **(K3)**

CO5: Design and implement the digital filter using suitable simulation tools. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3		-	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	3	3		-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction to Signals & Systems: Signal Definition, Signal Classification, System definition, System classification for both continuous time and discrete time, Basic Operations on Signals, Elementary Signals & Sequences, Definition of LTI systems, Transfer function of a LTI system, Concepts of Convolution and Correlation of signals, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different basic types of signals and systems. (L2)
- Understand various basic operations on signals and elementary signals. (L2)
- Describe continuous time signal and discrete time signal. (L2)

- Sketch the various types of basic signals for both continuous time & discrete time. (L3)
- Understand the LTI systems, convolution & correlation of signals. (L2)

UNIT – II (10 Hrs)

Fourier Series & Transform: Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems, Fourier Transform of arbitrary signal, Properties of Fourier Transform, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the periodic signals by applying Fourier series. (L4)
- Apply Fourier transform to solve problems. (L3)
- Analyze the spectral characteristics of signals. (L4)

UNIT – III (8 Hrs)

Analog Filters: Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of analog filters. (L2)
- Design and implement the analog Butterworth filters. (L4)

UNIT – IV (8Hrs)

Sampling Theorem & DFT: Sampling Theorem- Statement and proof, converting the analog signal to a digital signal, Practical sampling, The Discrete Fourier Transform, Properties of DFT, IDFT, Comparing the frequency response of analog and digital systems, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of sampling techniques. (L2)
- Illustrate signal sampling and its reconstruction. (L3)
- Explain the importance of discrete Fourier transform. (L3)

UNIT – V (10Hrs)

Digital Filters: Characteristics of FIR and IIR filters. Frequency response of ideal digital filters, Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, Comparison of FIR & IIR, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of IIR and FIR digital Filters. (L2)
- Analyze windowing techniques in FIR filters. (L4)
- Illustrate the digital filters of different techniques. (L3)
- Design IIR and FIR filters. (L4)

TEXTBOOKS:

1. "Signals, Systems and Communications", B. P. Lathi, BS Publications, 2008.
2. "Digital signal processing, principles, Algorithms and applications", John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 4th Edition, 2007.
3. "Discrete Time Signal Processing", A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

REFERENCE BOOKS:

1. "Linear Systems and Signals", B. P. Lathi, Oxford University press, 2nd Edition.
2. "Digital Signal Processing – Fundamentals and Applications", Li Tan, Elsevier, 2008.
3. "Signals, Systems and Transforms", C. L. Philips, J. M. Parr and Eve A. Riskin, PE, 3rd Edition, 2004.
4. "Signals and Systems", A.V. Oppenheim, A.S. Willsky and S. H. Nawab, PHI, 2nd Edition, 2013.
5. "Signals and Systems", A. Anand Kumar, PHI Publications, 3rd Edition, 2013.

Course Code	OPERATING SYSTEMS CONCEPTS		L	T	P	C
21A050501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To gain knowledge about the Operating Systems concepts such as process, main memory management, secondary memory management, CPU and disk scheduling etc.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the general architecture of computers **(K2)**
CO2: Describe, contrast and compare differing structures for operating Systems. **(K3)**
CO3: Analyse theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files. **(K4)**
CO4: Understand paging mechanism, virtual memory **(K2)**
CO5: Understand and identify the dead lock and methods to recovery the dead lock **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	2	1	-	-	-	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-	-	-
CO4	3	2	2	2	-	2	-	-	2	-	-	-	-	1
CO5	3	2	2	2	-	2	-	-	2	-	-	-	-	1

UNIT – I (9 Hrs)

Computer System and Operating System Overview: Overview of computer operating systems, operating systems functions, protection and security, distributed systems, special purpose systems, operating systems structures and systems calls, operating systems generation.

Learning Outcomes: At the end of this unit, students should be able to

- Identify major components of operating systems. (L1)
- Understand the types of computing environments. (L2)
- Explore several open-source operating systems. (L4)
- Recognize operating system services to users, processes and other systems. (L2)

UNIT – II (10 Hrs)

Process Management – Process concept- process scheduling, operations, Inter process communication. Multi Thread programming models. Process scheduling criteria and algorithms, and their evaluation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance, features of a process and methods of communication between processes. (L2)

- Examine CPU utilization through multi programming and multithreaded programming. (L3)

UNIT – III (8 Hrs)
Concurrency: Process synchronization, the critical- section problem, Peterson's Solution, synchronization Hardware, semaphores, classic problems of synchronization, monitors, Synchronization examples.
Learning Outcomes: At the end of this unit, students should be able to

- Examine the various Problems of Process Synchronization. (L3)

UNIT – IV (8 Hrs)
Memory Management: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation Virtual Memory Management: virtual memory, demand paging, page-Replacement, algorithms, Allocation of Frames, Thrashing.
Learning Outcomes: At the end of this unit, students should be able to

- Examine the various techniques of allocating memory to processes. (L3)
- Summarize how paging works in contemporary computer systems. (L4)
- Understanding the benefits of virtual memory systems. (L2)

UNIT – V (10 Hrs)
Principles of deadlock– system model, deadlock characterization, deadlock prevention, detection and avoidance, recovery form deadlock.
Learning Outcomes: At the end of this unit, students should be able to

- Investigate methods for preventing/avoiding deadlocks. (L4)
- Examine file systems and its interface in various operating systems. (L3)

TEXTBOOKS:

1. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, John Wiley, 7th Edition.
2. "Operating Systems – Internal and Design Principles", Stallings, Pearson education, 6th Edition, 2005.

REFERENCE BOOKS:

1. "Operating systems- A Concept based Approach", D. M. Dhamdhere, 2nd Edition, Tata McGraw Hill
2. "Operating System – A Design Approach", Crowley, TMH.
3. "Modern Operating Systems", Andrew S Tanenbaum, 3rd Edition, Prentice Hall International.

ONLINE LEARNING RESOURCES:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/Operating%20Systems/New_index1.html

Course Code	COMPUTER ARCHITECTURE & ORGANIZATION		L	T	P	C
21A050502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Principles and the Implementation of Computer Arithmetic
- Operation of CPUs including RTL, ALU, Instruction Cycle and Busses
- Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design
- Memory System and I/O Organization
- Principles of Operation of Multiprocessor Systems and Pipelining.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop a detailed understanding of computer systems **(K4)**

CO2: Cite different number systems, binary addition and subtraction, standard, floating-point, and micro-operations **(K3)**

CO3: Develop a detailed understanding of architecture and functionality of central processing unit **(K4)**

CO4: Exemplify in a better way the I/O and memory organization **(K3)**

CO5: Illustrate concepts of parallel processing, pipelining and inter processor communication. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating, Point Representation. Other Binary Codes, Error Detection Codes. Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Organization of Computers. (L2)
- Compare various Arithmetic Algorithms. (L5)

UNIT – II (10 Hrs)

Register Transfer Language and Micro operations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit. Basic Computer Organization and Design:

Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description.

Learning Outcomes: At the end of this unit, students should be able to

- Perform various functions using basic logical operations. (L5)
- Apply I/O and interrupts to execute various operations. (L4)

UNIT – III (8 Hrs)

Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Micro programmed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various addressing Modes. (L1)
- Compare various instruction formats. (L5)
- Design and other issues related to Control Unit. (L4)

UNIT – IV (8 Hrs)

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.

Learning Outcomes: At the end of this unit, students should be able to

- Compare various memories. (L3)
- Analyze various modes of transfer. (L5)

UNIT – V (8 Hrs)

Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration.

Pipeline: Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

Learning Outcomes: At the end of this unit, students should be able to

- Analyzing various processors. (L5)
- Compare various Pipeline. (L4)

TEXTBOOKS:

1. "Computer System Architecture", M. Morris Mano, Pearson, 3rd Edition, 2008.
2. "Computer Organization", Carl Hamacher, Zvonko Vranesic, Safwat Zaky, McGraw Hill, 5th Edition, 2002.

REFERENCE BOOKS:

1. "Computer Organization and Architecture", William Stallings, Pearson, 6th Edition, 2006.
2. "Structured Computer Organization", Andrew S. Tanenbaum, Pearson, 4th Edition, 2005.
3. "Fundamentals of Computer Organization and Design", Sivarama P. Dandamudi, Springer, 2006.

ONLINE LEARNING RESOURCES:

1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

OPEN ELECTIVE – II

Course Code	ENVIRONMENTAL POLLUTION AND CONTROL		L	T	P	C
21A010502			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart knowledge on aspects of air pollution & control and noise pollution.
- To impart concepts of treatment of waste water from industrial source.
- To differentiate the solid and hazardous waste based on characterization.
- To introduce sanitation methods essential for protection of community health.
- To provide basic knowledge on sustainable development.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the fundamentals of solid waste management, practices adopted in his town / village and its importance in keeping the health of the city. **(K2)**

CO2: Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards**. (K2)**

CO3: Differentiate the treatment techniques used for sewage and industrial wastewater Treatment. **(K3)**

CO4: Integrate the methods of environmental sanitation and the management of community facilities without spread of epidemics. **(K6)**

CO5: Appraise the importance of sustainable development while planning a project or executing an activity. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

AIR POLLUTION:

Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

Learning Outcomes: At the end of this unit, students should be able to

- Understand control mechanism of air pollutants. (L2)
- Design noise reduction techniques. (L6)

UNIT – II (9 Hrs)

INDUSTRIAL WASTE WATER MANAGEMENT:

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of treatment process of industrial effluents. (L2)
- Design treatment plants. (L6)

UNIT – III (9 Hrs)

SOLID WASTE MANAGEMENT: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

HAZARDOUS WASTE: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Learning Outcomes: At the end of this unit, students should be able to

- Categorize of solid waste and separation and procession solid waste. (L4)
- Estimate Hazardous wastes. (L5)
- Develop execute solid waste and hazardous waste management. (L6)

UNIT – IV (9 Hrs)

ENVIRONMENTAL SANITATION: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of hygienic environment. (L2)
- Choose appropriate rural sanitation methods to keep surrounding clean. (L5)

UNIT – V (9 Hrs)

SUSTAINABLE DEVELOPMENT: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability-sustainable
development.

Learning Outcomes: At the end of this unit, students should be able to

- Express sustainable development strategies. (L6)

TEXTBOOKS:

1. "Environmental Engineering", Peavy, H. S., Rowe, D.R, Tchobanoglous, Mc-Graw Hill International Editions, New York 1985.
2. "Environmental Science and Engineering", J. G. Henry and G. W. Heinke, Pearson Education.

REFERENCE BOOKS:

1. "Waste water treatment- concepts and design approach", G. L. Karia and R.A. Christian, Prentice Hall of India
2. "Air pollution", M. N. Rao and H. V. N. Rao, Tata Mc.Graw Hill Company.
3. "Weiner and Robin Matthews Environmental Engineering", Ruth F., Elesevier, 4th Edition, 2003.
4. "Air Pollution and Control", K. V. S. G. Murali Krishna, Kousal & Co. Publications, New Delhi.

Course Code	SMART GRID		L	T	P	C
21A020503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Impart knowledge on relevance smart grids technologies, its potential challenges and applications to the real world.
- Provide deeper insight on the customer's needs and consumption pattern for better load management and forecasting.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operational and functional aspects of smart grid, architecture and technical challenges. **(K2)**

CO2: Analyze the communication signals from various measuring units and sub-networks for monitoring secured operation adhering relevant standards. **(K4)**

CO3: Assess the various energy options and apply them for the sustainability of Smart grid. **(K2)**

CO4: Develop strategies for demand side management using various communication protocols. **(K3)**

CO5: Understand the challenges and relevant standards in interoperability and cyber security of Smart grid. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to Smart Grid: Introduction to smart grid as per National Institute Standards and Technology (NIST), smart grid architecture, functions of smart grid components, smart grid initiatives in India, technology drivers and challenges. Overview of the technologies required for smart grid and architecture of smart substation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concept of smart grid Technology. (L2)
- Explain Smart grid functions. (L3)
- Understand Smart grid architecture. (L2)

UNIT – II (9 Hrs)

Smart Grid Measurement Technology: Introduction, standards for information exchange, monitoring, smart meters, and measurement technologies, WAMS, PMUs, GIS and google mapping tools and multi-agent systems technology.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the measurement technologies. (L2)
- Explain the google mapping tools. (L3)
- Compare WAMS and PMU. (L3)

UNIT – III (9 Hrs)

Sustainable Energy Options for the Smart Grid: Renewable Energy Resources, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, Storage Technologies.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of Renewable energy source. (L3)
- Understand basic concept of Electric Vehicles. (L2)

UNIT – IV (9 Hrs)

Demand Side Management and Communication Technology: Introduction, Demand Side Management objectives and its classification. Communication technologies: IEEE 802X series. Layouts of Sub-networks: LAN, WAN, NAN, HAN and FAN and its comparison.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic concepts of management objectives. (L3)
- Compares the WAN, LAN, NAN, HAN. (L3)

UNIT – V (9 Hrs)

Interoperability, Standards and Cyber Security : Introduction, State-of-the-Art-Interoperability, Benefits and Challenges of Interoperability, Model for Interoperability in the Smart Grid Environment, Smart Grid Network Interoperability, Interoperability and Control of the Power Grid, Standards, Approach to Smart Grid Interoperability Standards, Smart Grid Cyber Security, Cyber Security State of the Art, Cyber Security Risks, cyber security concerns associated with Advanced Metering Infrastructure, Mitigation approach to cyber security risks.

Learning Outcomes: After successful completion of this unit, the students will be able to

- Understand basic Benefits and Challenges of Interoperability. (L2)
- Analyze Smart Grid Network Interoperability. (L4)

TEXTBOOKS:

1. "Smart Grid: Fundamentals of design and analysis", James Momoh, John Wiley & sons Inc, IEEE press, 2012

2. "Smart Grid: Technology and Applications", Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons Inc., 2012.

REFERENCE BOOKS:

1. "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Fereidoon P. Shoshonis, Academic Press, 2012
2. "The smart grid: Enabling energy efficiency and demand response", Clark Grellings, Fairmont Press Inc, 2009.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/107/108107113/
2. https://smartgrid.ieee.org/resources/webinars

Course Code	ENERGY STORAGE SYSTEMS		L	T	P	C
21A020504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need for energy storage
- Understand about the fundamentals of ESS
- Know about types, features and benefits of ESS
- Know about various management and control including market potential of ESS
- Study about various applications of ESS

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: To get exposed to latest technology of ESS. **(K3)**

CO2: Understand the principle, features, and benefits of ESS. **(K2)**

CO3: Understand the marketing and management strategies of ESS in working environment. **(K2)**

CO4: Distinguish wide variety of applications of EES for practical applications. **(K2)**

CO5: Know about latest technology applications of Battery SCADA, which is going to be vital in future applications, trend in new and renewable energy source. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Fundamentals of ESS: Definitions, Characteristics of ESS, Electricity, and roles of ESSs, Emerging needs in ESS, Classification of ESSs, Roles of Electrical storage technologies.

Learning Outcomes: At the end of the unit, students should be able to

- To know about the fundamentals of ESS. (L4)
- To know about emerging needs and roles of ESS. (L4)
- To know about various classifications of ESS. (L4)
- To understand about roles of energy storage technologies. (L2)

UNIT – II (9 Hrs)

Types and Features of ESS Technologies: Mechanical storage systems, Electromechanical storage systems, Chemical energy storage, Electrical storage systems, Thermal storage systems, standards for EES, Comparison of ESS technology storage systems, Power and discharge duration, Energy and power density, Storage operating cost, Power quality, Reactive power capability.

Learning Outcomes: At the end of the unit, students should be able to

- To understand about various types of ESS technologies. (L2)
- To understand about standards for ESS. (L2)
- To learn about power and discharge duration of ESS. (L2)
- To know about preliminaries of ESS operating cost. (L4)
- To understand about power quality issues and reactive power capability of ESS. (L2)

UNIT – III (9 Hrs)

Storage Benefits: Definitions, Applications, specifications, benefits, Electric energy time shift, Electric supply capacity, reserve capacity, voltage support, Electric service power quality and reliability, Incidental benefits, energy losses, access charges, Risk, dynamic operating benefits, p.f. correction, reduced air emissions, flexibility, energy benefits.

Learning Outcomes: At the end of the unit, students should be able to

- To know various storage benefits. (L4)
- To distinguish between application specific benefits and identical benefits. (L2)
- To understand about electric service power quality and reliability issues. (L2)
- To learn about energy benefits from storage systems. (L3)

UNIT – IV (9 Hrs)

EES Market and Management: Utility and Consumer use, Measurement and Control hierarchy, Internal configurations, External connections, Battery SCADA, Market potential, estimation, role of aggregators, Maximum market potential estimates, Demand change management, Time-of-use energy cost management, storage modularity.

Learning Outcomes: At the end of the unit, students should be able to

- To understand about management of ESS technologies. (L2)
- To distinguish between internal and external configuration of ESS. (L2)
- To know about battery SCADA system and storage modularity. (L4)
- To distinguish between demand change and time-of-use energy cost management. (L2)

UNIT – V (9 Hrs)

Applications of EES: Power Vs Energy, Capacity Vs energy applications, specific power and discharge durations, Electric supply applications, ancillary service applications, End user/utility customer applications, Distributed energy storage applications, Locational, Non-locational and incidental applications.

Learning Outcomes: At the end of the unit, students should be able to

- To know about various ESS. (L4)

- To distinguish between power, capacity, energy applications of ESS. (L2)
- To distinguish between electric supply and ancillary applications. (L2)
- To understand about the importance of distributed energy storage applications. (L2)

TEXTBOOKS:

1. "Energy Storage Benefits and Market Analysis", James M. Eyer, Joseph J. Iannucci and Garth P. Corey, Sandia National Laboratories, 2004
2. "The Electrical Energy Storage", IEC Market Strategy Board, White paper.

REFERENCE BOOKS:

1. "Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide", Jim Eyer, Garth Corey, Sandia National Laboratories", Feb 2010.

<table>
<tr><td>Course Code</td><td rowspan="2">PRINCIPLES OF COMMUNICATION SYSTEMS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A040503</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="3">VI</td></tr>
</table>

COURSE OBJECTIVES:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

COURSE OUTCOMES:

At the end of this course, student will be able to

CO1: Apply the concept of amplitude modulation to solve engineering problems. **(K3)**
CO2: Analyze the Angle modulation & demodulation systems in time & frequency domains. **(K4)**
CO3: Analyze different Analog Pulse modulation & demodulation techniques. **(K4)**
CO4: Explain various digital modulation schemes. **(K3)**
CO5: Understand the concept of various communication systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Amplitude Modulation: An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of noise, Fourier transform, career modulation and frequency division multiplexing. (L2)
- Apply the concept of amplitude modulation to solve engineering problems. (L3)

UNIT – II (9 Hrs)

Angle Modulation: Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of angle modulation and its components. (L2)

- Apply the concept of frequency modulation to solve engineering problems. (L3)
- Analyse angle modulation schemes. (L4)
- Evaluate frequency modulation scheme in real time applications. (L4)

UNIT – III (8 Hrs)

Pulse Modulation: Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing. (L2)
- Explain various pulse modulation schemes. (L4)

UNIT – IV (9 Hrs)

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various digital modulation schemes. (L2)
- Analyze various digital modulation schemes. (L4)

UNIT – V (9 Hrs)

Communication Systems: Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various communication systems. (L2)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Principles of Communication Systems", Herbert Taub, Donald L Schilling and Goutam Saha, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

REFERENCE BOOKS:

1. "Modern Digital and Analog Communication Systems", B. P. Lathi, Zhi Ding and Hari M. Gupta, 4th Edition, Oxford University Press, 2017.
2. "Digital and Analog Communication Systems", K. Sam Shanmugam, Wiley India Edition, 2008.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108104091
2. https://www.eeeguide.com/principles-of-communication-systems
3. https://ncert.nic.in/ncerts/l/leph207.pdf

Course Code	ELECTRONIC INSTRUMENTATION		L	T	P	C
21A040504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

This course will enable students to:

- To introduce various measuring instruments and their functionality.
- To teach various measurement metrics for performance analysis.
- To explain principles of operation and working of different electronic instruments.
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.
- To provide exposure to different types of transducers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the different methods for measurement of various electrical quantities. **(K2)**
CO2: Compare the various measuring techniques for measuring voltage. **(K4)**
CO3: Measure amplitude and frequency utilizing oscilloscopes. **(K5)**
CO4: Analyze the functioning of various types of probes, derive the balanced condition for various bridges. **(K4)**
CO5: Measure various physical parameters by appropriately selecting the transducers. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (10 Hrs)

Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. **Ammeters:** DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. **Voltmeters and Multi-meters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of measurement system. (L2)
- Explain the characteristics of different Instruments. (L2)

- Illustrate different types of errors that may occur in instruments during measurements. (L2)

UNIT – II (9 Hrs)

Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM.

Digital Instruments: Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

Learning Outcomes: At the end of this unit, students should be able to

- Explain working of digital measuring Instruments. (L2)
- Compare the various measuring techniques for measuring voltage. (L4)

UNIT – III (9 Hrs)

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope.

Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator.

Learning Outcomes: At the end of this unit, students should be able to

- Measure parameters viz. Amplitude, frequency and time period using CRO. (L5)
- Classify signal generators and describe its characteristics. (L2)

UNIT – IV (8 Hrs)

Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger.

Bridges: Introduction, Wheatstone‘s bridge, Kelvin‘s Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell‘s bridge, Wien‘s bridge.

Learning Outcomes: At the end of this unit, students should be able to

- Describe function of various measuring Instruments. (L2)
- Describe how unknown capacitance and inductance can be measured using bridges. (L2)
- Select appropriate bridge for measuring R, L and C parameters. (L2)
- Analyze the functioning of various types of probes derive the balanced condition for various bridges. (L4)

UNIT – V (9 Hrs)

Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive

transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of transducer. (L2)
- Measure various physical parameters by appropriately selecting the transducers. (L5)

TEXTBOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, McGraw Hill, 3rd Edition, 2012, ISBN: 9780070702066.
2. "Modern Electronic Instrumentation and Measuring Techniques", A. D. Helfrick and W.D. Cooper, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

REFERENCE BOOKS:

1. "Electronic Instrumentation & Measurements", David A. Bell, Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.
2. "Electronics and Electrical Measurements", A. K. Sawhney, Dhanpat Rai &Sons. ISBN - 81-7700-016-0

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/108105064/
2. http://nptel.ac.in/courses/108105062/

Course Code	JAVA PROGRAMMING		L	T	P	C
21A050503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Focus on object oriented concepts and java program structure and its installation.
- Comprehension of java programming constructs, control structures in Java.
- Implementing Object oriented constructs such as various class hierarchies, interfaces and exception handling.
- Understanding of Thread concepts and I/O in Java.
- Being able to build dynamic user interfaces using applets and Event handling in java.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use of objects to program. **(K3)**
CO2: Create programs by using Java basic Constructs. **(K3)**
CO3: Implement OOPs concepts. **(K3)**
CO4: Develop JAVA applets applications. **(K4)**
CO5: Apply multi-threaded concepts in programming. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	-	-	2	2	3	2	-	3	2
CO2	3	2	3	2	3	-	-	2	2	3	-	-	3	2
CO3	3	2	2	1	3	-	-	2	2	3	-	1	1	2
CO4	3	2	2	2	3	-	-	2	2	3	1	-	1	2
CO5	3	2	2	2	3	-	-	2	2	3	1	1	1	2

UNIT – I (8 Hrs)

Introduction to OOP: Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6

Learning Outcomes: At the end of this unit, students should be able to

- Understand the syntax, semantics and features of Java Programming Language. (L1)
- Compare Object Oriented and Procedural Languages. (L4)

UNIT – II (9 Hrs)

Programming Constructs: Variables, Primitive Data types, Identifiers- Naming Coventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control- Branching, Conditional, loops. Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-

Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments.

Learning Outcomes: At the end of this unit, students should be able to

- Developing simple programs with java constructs. (L5)
- Learning about various Keywords in Java and their uses. (L1)

<u>UNIT – III</u> (9 Hrs)

Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class. Interfaces, Packages and Enumeration: Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages, using Packages, Access protection, java.lang package. Exceptions & Assertions – Introduction, Exception handling techniques- try catch, throw, throws, finally block, user defined exception.

Learning Outcomes: At the end of this unit, students should be able to

- Implement types of Inheritance and developing new classes based on existing classes. (L4)
- Distinguish between system packages and user defined packages. (L4)
- Demonstrate features of interfaces to implement multiple inheritances. (L3)
- Applying Exception in Programs where necessary. (L4)

<u>UNIT – IV</u> (6 Hrs)

Multi Threading: java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading-Synchronization, suspending and Resuming threads, Communication between Threads Input / Output: reading and writing data, java.io package

Learning Outcomes: At the end of this unit, students should be able to

- Understand concurrency, parallelism and multithreading. (L2)
- Create multitasking applications. (L5)

<u>UNIT – V</u> (9 Hrs)

Applets– Applet class, Applet structure, An Example Applet Program, Applet : Life Cycle, paint(), update() and repaint() Event Handling -Introduction, Event Delegation Model, java.awt. event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the GUI programming. (L2)
- Perform event Handling in java GUI Programs. (L5)

<u>TEXTBOOKS:</u>

1. "The Complete Reference Java", Herbert Schildt, TMH, 8th Edition
2. "Programming in JAVA", Sachin Malhotra, Saurabh choudhary, Oxford.
3. "JAVA for Beginners", Joyce Farrell, Ankit R. Bhavsar, Cengage Learning, 4th Edition.

4. "Object oriented programming with JAVA, Essentials and Applications", Raj Kumar Bhuyya, Selvi, Chu TMH.
5. "Introduction to Java Programming", Y Daniel Liang, Pearson, 7th Edition.

REFERENCE BOOKS:

1. "JAVA Programming", K. Rajkumar. Pearson.
2. "Core JAVA, Black Book", Nageswara Rao, Wiley, Dream Tech
3. "Core JAVA for Beginners", Rashmi Kanta Das, Vikas.
4. "Object Oriented Programming through JAVA", P Radha Krishna, University Press.

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/java/
2. https://www.javatpoint.com/java-tutorial

Course Code	BASICS OF DATABASE MANAGEMENT SYSTEMS		L	T	P	C
21A050504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Provides students with theoretical knowledge and practical skills in the use of databases.
- Database management systems in information technology applications.
- The logical design, physical design and implementation of relational databases are covered.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Define a Database Management System. **(K2)**
CO2: Compare the advantages and disadvantages of the different models. **(K4)**
CO3: Design Database using E-R Diagram (SQL). **(K4)**
CO4: Analyze the rules guiding transaction ACID properties. **(K4)**
CO5: Analyze file organization while storing and retrieving the data base **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	-	2	1	1	2	3	2
CO2	3	2	1	2	1	1	-	-	2	-	1	2	3	2
CO3	3	3	2	2	1	-	-	-	2	-	2	2	1	2
CO4	3	3	2	2	1	-	-	-	2	-	2	2	1	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	1	2

UNIT – I (10 Hrs)

INTRODUCTION: Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Data base systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between Database and File System. (L4)
- Categorize different kinds of data models. (L4)
- Define functional components of DBMS. (L2)

UNIT – II (8 Hrs)

RELATIONAL MODEL: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance **BASIC SQL:** Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

Learning Outcomes: At the end of this unit, students should be able to

- Outline the elements of the relational model such as domain, attribute, tuple, relation and entity. (L2)
- Distinguish between various kinds of constraints like domain, key and integrity. (L4)
- Define relational schema Develop queries using Relational Algebra and SQL. (L2)
- Perform DML operations on databases. (L4)

UNIT – III (8 Hrs)

ENTITY RELATION MODEL: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. **SQL:** Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations.

Learning Outcomes: At the end of this unit, students should be able to

- Develop E-R model for the given problem. (L4)
- Derive tables from E-R diagrams. (L4)

UNIT – IV (8 Hrs)

TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods: lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes, Database Recovery management : Transaction recovery. SQL constructs that grant access or revoke access from user or user groups. Basic PL/SQL procedures, functions and triggers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various properties of transaction. (L1)
- Design atomic transactions for an application. (L4)
- Gain the knowledge about log mechanism and check pointing techniques for system recovery. (L2)
- Create PLSQL programs and triggers for different database conditions. (L5)

UNIT – V (9 Hrs)

STORAGE AND INDEXING: Database file organization, file organization on disk, heap files and sorted files, hashing, single and multi-level indexes, dynamic multilevel indexing using B-Tree and B+ tree, index on multiple keys.

Learning Outcomes: At the end of this unit, students should be able to

- Understand file organization (L2)
- Compare various indexing techniques (L4)

TEXTBOOKS:

1. "Database Management Systems", Raghuram Krishnan, Johannes Gehrke, TMH, 3rd Edition
2. "Database Management System", Ramez Elmasri, Shamkant B. Navathe, PEA, 6th Edition
3. "Database Principles Fundamentals of Design Implementation and Management", Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

REFERENCE BOOKS:

1. "Database System Concepts", Silberschatz, Korth, TMH, 5th Edition
2. "Introduction to Database Systems", C J Date, PEA, 8th Edition

WEBLINKS

1. https://www.javatpoint.com/dbms-tutorial
2. https://www.geeksforgeeks.org/dbms/

OPEN ELECTIVE – III

Course Code	DISASTER MANAGEMENT AND MITIGATION		L	T	P	C
21A010503			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To obtain the basic knowledge of Environmental Hazards and disasters.
- To understand the basics of Endogenous and Exogenous hazards and gives a suitable picture on the different types of hazard and disaster mitigation methods.
- To understand the key concepts of disaster management related to development and the relationship of different disaster management activities.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze and evaluate the environmental, social, cultural, economic, legal and organizational Aspects influencing vulnerabilities and capacities to face disasters and to know about different types of environmental hazards. **(K4)**

CO2: Compute knowledge on different types of natural and man- made disasters. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery). **(K3)**

CO3: Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ. **(K3)**

CO4: Identify endogenous and exogenous hazards their harmful effects to the environment, Case studies of India. **(K1)**

CO5: Identify the regulatory controls used in hazard management. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO2	3	3	3	3	-	-	2	1	-	-	2	-	2	-
CO3	3	3	3	3	-	-	2	2	-	-	2	-	2	-
CO4	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO5	3	3	2	3	-	-	2	1	-	-	2	-	3	-

UNIT – I (8 Hrs)

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Learning Outcomes: At the end of this unit, students should be able to

- Debate on the Knowledge of the disaster phenomenon, its different contextual aspects, impacts and public health consequences. (L5)
- Express about the natural hazards and its management. (L6)

UNIT – II (10 Hrs)

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

Learning Outcomes: At the end of this unit, students should be able to

- Explain the Capacity to manage the Public Health aspects of the disasters. (L4)
- Distinguish the different types of environmental hazards & disasters. (L5)

UNIT – III (9 Hrs)

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the regulations of building codes and land use planning related to risk and vulnerability. (L4)
- Justify the financial management of disaster and related losses. (L6)

UNIT – IV (9 Hrs)

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Mitigation and control measures of exogenous hazards. (L2)
- Analyze, and communicate information on risks, relief needs and order to formulate strategies for mitigation. (L4)

UNIT – V (9 Hrs)

Soil Erosion: - Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion. Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global

Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation. Biological hazards/ disasters:- Population Explosion.

Learning Outcomes: At the end of this unit, students should be able to

- Relate their interconnections, particularly in the field of the Public Health aspects of the disasters. (L3)
- Understand different approaches to prevent disasters. (L2)

TEXTBOOKS:

1. "Disaster Management", Rajib Shah, Universities Press, India, 2003
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Disaster Mitigation: Experiences and Reflections", Pardeep Sahni
4. "Natural Hazards & Disasters", Donald Hyndman & David Hyndman, Cengage Learning.

REFERENCE BOOKS:

1. "The Environment as Hazards", Kates, B.I & White, G.F, Oxford Publishers, New York, 1978
2. "Disaster Management", R.B. Singh (Ed), Rawat Publication, New Delhi, 2000
3. "Disaster Management", H.K. Gupta (Ed), Universities Press, India, 2003
4. "Space Technology for Disaster Mitigation in India (INCED)", R.B. Singh, University of Tokyo, 1994.

ONLINE LEARNING RESOURCES:

1. http://ndma.gov.in
2. http://www.ndrf.gov.in

Course Code	RENEWABLE ENERGY SYSTEMS		L	T	P	C
21A020505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand various alternate sources of energy for different suitable application requirements. **(K2)**
CO2: Understand the concepts of solar energy generation strategies and wind energy system. **(K2)**
CO3: Analyze Solar and Wind energy systems. **(K4)**
CO4: Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass, and fuel cells. **(K2)**
CO5: Understand the fundamentals of Solar and Wind energy systems. **(K2)**

CO-POMAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

Learning Outcomes: At the end of the unit, students should be able to

- Understanding renewable and nonrenewable energy resources. (L2)
- Understand the various forms of conventional energy resources. (L2)
- Understanding of Solar power properties. (L2)

UNIT – II (8 Hrs)

PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film

PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the PV cells and modules. (L2)
- Disseminate information on PV. (L3)

UNIT – III (10 Hrs)

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

Learning Outcomes: At the end of the unit, students should be able to

- Understanding of wind energy production. (L2)
- Outline division aspects and utilization of renewable energy sources for both domestics and industrial application. (L3)
- Understand the need of Wind Energy and the various components used in energy generation and know the classification. (L2)

UNIT – IV (8 Hrs)

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Learning Outcomes: At the end of the unit, students should be able to

- Identify the Resources of geothermal energy.(L2)

UNIT – V (10 Hrs)

Miscellaneous Energy Technologies: Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the concept of Biomass energy resources and their classification. (L2)
- Analyze the performance of Ocean Energy. (L4)

TEXTBOOKS:

1. “Renewable Energy Power for a Sustainable Future”, Stephen Peake, Oxford

International Edition, 2018.
2. “Non-Conventional Energy Sources”, G. D. Rai, Khanna Publishers, 4th Edition, 2000.

REFERENCE BOOKS:

1. “Solar Energy”, S. P. Sukhatme, Tata Mc Graw Hill Education Pvt. Ltd, 3rd Edition, 2008.
2. “Non-Conventional Energy Resources”, B H Khan, Tata Mc Graw Hill Education Pvt Ltd, 2nd Edition, 2011.
3. “Non-Conventional Energy Resources”, S. Hasan Saeed and D. K. Sharma, S. K. Kataria & Sons, 3rd Edition, 2012
4. “Renewable Energy Resource: Basic Principles and Applications”, G. N. Tiwari and M. K. Ghosal, Narosa Publishing House, 2004

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

Course Code	CONCEPTS OF ELECTRICAL DRIVES AND APPLICATIONS		L	T	P	C
21A020506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the choice of the electric drive system based on their applications. **(K2)**

CO2: Explain the operation of single and multi-quadrant electric drive. **(K3)**

CO3: Analyze single phase and 3-phase rectifiers fed DC motors and chopper fed DC motors. **(K4)**

CO4: Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors with closed loop, and open loop operations. **(K3)**

CO5: Explain the speed control methods for AC-AC & DC-AC converters fed to Synchronous motors with closed loop, and open loop operations. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Converter Fed DC Motors: Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase semi and fully controlled converters connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic electrical drive elements and its function. (L2)
- Analyze the single-phase dc drives and its speed-torque characteristics. (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – II (9 Hrs)

Four Quadrant Operation of DC Drives: Introduction to Four Quadrant Operation – Motoring

Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only).

Learning Outcomes: At the end of the unit, students should be able to

- Understand the four-quadrant operation of the dc drives. (L2)
- Analyze the various motoring and braking operations of the dc motors. (L4)
- Understand the closed loop operation of the dc drives. (L2)

UNIT – III (9 Hrs)

Chopper fed DC Motors: Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics– Problems on Chopper Fed D.C Motors.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basics concepts of choppers and its operation. (L2)
- Analyze the classification of various choppers feeding the dc drives. (L4)

UNIT – IV (9 Hrs)

Control of Induction Motor: Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers–Waveforms – Speed Torque Characteristics - Stator Frequency Control and characteristics. Voltage Source and Current Source Inverter – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Static Rotor Resistance Control

Learning Outcomes: At the end of the unit, students should be able to

- Understand the various speed control methods of induction motor used in drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods to induction motor on rotor side. (L3)

UNIT – V (9 Hrs)

Control of Synchronous Motors: Separate Control & Self Control of Synchronous Motors – Operation of Self-Controlled Synchronous Motors by VSI and CSI. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque Characteristics – Applications – Advantages.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the self and separate control methods of synchronous motor drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods of synchronous motors. (L4)

TEXTBOOKS:

1. "Power semiconductor-controlled drives", G K Dubey, Prentice Hall, 1995.

2. “Modern Power Electronics and AC Drives”, B. K. Bose, PHI, 2002.

REFERENCE BOOKS:

1. “Power Electronics”, MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. “Power Electronic Circuits, Devices and applications”, M. H. Rashid, PHI, 2005.
3. “Electric drives Concepts and Applications”, Vedam Subramanyam, Tata McGraw Hill Publications, 2nd Edition, 2011.

Course Code	ELECTRONIC SENSORS		L	T	P	C
21A040505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To learn the characterization of sensors.
- To know the working of Electromechanical, Thermal, Magnetic and radiation sensors
- To understand the concepts of Electro analytic and smart sensors
- To be able to use sensors in different applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the Principles of different sensors, Characterization and working of Electro mechanical Sensors. **(K3)**
CO2: Analyze the working of Thermal sensors. **(K4)**
CO3: Compare the working of magnetic resistor and hall effect sensors. **(K4)**
CO4: Explain the working of radiation and Electro analytic Sensors. **(K3)**
CO5: Develop a system with smart sensors. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (9 Hrs)

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of sensors/Transducers principles. (L2)
- Understand the concepts of Electro mechanical sensors. (L2)
- Identify the operation of Inductive and capacitive sensors. (L3)

UNIT – II (9 Hrs)

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Thermal sensors. (L2)
- Understand the working of Thermal radiation sensors. (L2)
- Identify the types of semiconductor sensors. (L3)
- Analyse the operation of heat flux sensors. (L4)

UNIT – III (9 Hrs)

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principles of Magnetic sensors. (L2)
- Summarize the concepts of Angular transducers. (L2)
- Compare the working of magnetic resistor and Hall effect sensors. (L4)

UNIT – IV (9 Hrs)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors, Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of radiation sensors. (L2)
- Summarize the types of photo detectors. (L2)
- Explain different electrodes and sensors. (L3)

UNIT – V (9 Hrs)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications, Introduction- On-board Automobile

Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of smart sensors. (L2)
- Summarize the applications of automation sensor. (L2)
- Develop different sensors used in the industries and manufacturing. (L3)

TEXTBOOKS:

1. "Sensors and Transducers", D. Patranabis, PHI Learning Private Limited., 2003.
2. "Introduction to sensors", John veteline, Aravind Raghu, CRC press, 2011

REFERENCE BOOKS:

1. "Sensors and Actuators", D. Patranabis, PHI, 2nd Edition, 2013.
2. "Make sensors", Tero Karvinen, Kimmo Karvinen and Ville Valtokari, Maker media, 1st Edition, 2014.
3. "Sensors handbook", Sabrie Soloman, TMH, 2nd Edition, 2009

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108147
2. http://www.nitttrc.edu.in/nptel/courses/video/101104066/101104066.html

Course Code	INTRODUCTION TO IMAGE PROCESSING		L	T	P	C
21A040506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce fundamentals of Image Processing.
- To expose various intensity transformations in spatial and frequency domains.
- To impart concepts of wavelets and various coding techniques for image compression.
- To dissimilate various segmentation techniques for images.
- To teach various color models and to introduce the concepts of color image segmentation.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various types of images mathematically. **(K4)**
CO2: Compare image enhancement methods in spatial and frequency domains. **(K3)**
CO3: Apply various segmentation algorithms for processing an image. **(K3)**
CO4: Categorize various compression techniques and color models. **(K4)**
CO5: Apply various techniques for color image smoothing, sharpening and segmentation. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO4	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels: neighbourhood, adjacency, connectivity, distance measures. Mathematical tools/ operations applied on images.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic building blocks of image processing. (L2)
- Define image processing parameters such as adjacency and distance measures. (L1)
- Analyze various types of images mathematically. (L4)

UNIT – II (9 Hrs)

Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Learning Outcomes: At the end of this unit, students should be able to

- Apply spatial domain and frequency Domain filtering techniques for image enhancement (L3)
- Compare image enhancement methods in spatial and frequency domains. (L3)

UNIT – III (9 Hrs)

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various Image segmentation techniques. (L2)
- Illustrate detection of discontinuities in an image. (L2)
- Apply various segmentation algorithms for processing an image. (L3)

UNIT – IV (9 Hrs)

Image Compression: Redundancy, inter-pixel and psycho-visual; Loss less compression-predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various transform techniques for lossy compression. (L2)
- Apply various coding techniques for lossless compression. (L3)

UNIT – V (9 Hrs)

Color Image Processing: Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various color models for color image processing. (L2)
- Apply various techniques for color image smoothing, sharpening and segmentation. (L3)

TEXTBOOKS:

1. "Digital Image Processing", R.C. Gonzalez and R.E. Woods, Pearson Education, 2nd Edition, 2008.
2. "Fundamentals of Digital Image Processing", Anil Kumar Jain, Prentice Hall of India, 2nd Edition 2004.

REFERENCE BOOKS:

1. "Digital Image processing using MATLAB", Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Tata McGraw Hill, 2010.
2. "Image Processing, Analysis, and Machine Vision", Milan Sonka, Vaclav Hlavac, Roger Boule, Cengage Learning, 3rd Edition, 2016.
3. "Digital Image processing", S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.
4. "Digital Image Processing", William K. Pratt, John Wiley, 3rd Edition, 2004.

ONLINE LEARNING RESOURCES:

1. https://www.udemy.com/course/learn-image-analysis/
2. https://alison.com/tag/image-processing
3. https://nptel.ac.in/courses/117/105/117105135/

Course Code	INTRODUCTION TO INTERNET OF THINGS		L	T	P	C
21A050505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

COURSE OUTCOMES:

At the end of the unit, students will be able to:

CO1: Analyze various protocols for IoT. **(K4)**
CO2: Design a PoC of an IoT system using Raspberry Pi/Arduino. **(K3)**
CO3: Apply data analytics and use cloud offerings related to IoT. **(K3)**
CO4: Analyze applications of IoT in real time scenario. **(K4)**
CO5: Analyze applications of IoT in real time Applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	-	2	1	1	2	3	-
CO2	3	2	1	2	1	1	-	-	2	-	1	2	3	-
CO3	3	3	2	2	1	-	-	-	2	-	2	2	3	-
CO4	3	3	2	2	1	-	-	-	2	-	2	2	3	-
CO5	3	3	2	2	1	-	-	-	2	-	2	2	3	-

UNIT – I (10 Hrs)

FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain IoT architecture. (L2)
- Interpret the design principles that govern connected devices. (L2)
- Summarize the roles of various organizations for IoT. (L2)
- Interpret the significance of Prototyping. (L2)

UNIT – II (10 Hrs)

IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP

versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basics of microcontrollers. (L2)
- Outline the architecture of Arduino. (L2)
- Develop simple applications using Arduino. (L3)
- Outline the architecture of Raspberry Pi. (L2)
- Develop simple applications using Raspberry Pi. (L3)
- Select a platform for a particular embedded computing application. (L3)

UNIT – III (8 Hrs)

DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

Learning Outcomes: At the end of this unit, students should be able to

- Interpret different protocols and compare them. (L2)
- Select which protocol can be used for a specific application. (L3)
- Utilize the Internet communication protocols for IoT applications. (L3)
- Select IoT APIs for an application. (L3)
- Design and develop a solution for a given application using APIs. (L6)
- Test for errors in the application. (L4)

UNIT – IV (8 Hrs)

DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

Learning Outcomes: At the end of this unit, students should be able to

- Plan the business model. (L6)
- Predict the market value. (L6)
- Build the product. (L6)

UNIT – V (9 Hrs)

CASE STUDIES/INDUSTRIAL APPLICATIONS: Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility

Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the manufacturing techniques. (L2)
- Adapt the Ethics of the IoT. (L6)

TEXTBOOKS:

1. "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

REFERENCE BOOKS:

1. "Database System Concepts", Silberschatz, Korth, TMH, 5th Edition
2. "Introduction to Database Systems", C J Date, PEA, 8th Edition
3. "The Database book principles & practice using Oracle/MySql", Narain Gehani, University Press.

ONLINE LEARNING RESOURCES:

1. https://en.wikipedia.org/wiki/Cloud_computing
2. https://www.infoworld.com/article/2683784/what-is-cloud-computing.html

Course Code	WEB TECHNOLOGIES FOR BEGINNERS		L	T	P	C
21A050506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- This course is designed to introduce students with no programming experience to the programming languages
- Techniques associated with the World Wide Web.
- The course will introduce web-based media-rich programming tools for creating interactive web pages.

COURSE OUTCOMES:

After completing the course student will be able to

CO1: Analyze a web page and identify its elements and attributes. **(K4)**
CO2: Create web pages using XHTML and Cascading Styles sheets. **(K5)**
CO3: Build dynamic web pages. **(K5)**
CO4: Build web applications using PHP. **(K5)**
CO5: Programming through PERL and Ruby, client-side scripts using AJAX **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	3	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	3	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	3	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	3	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	3	-

UNIT – I (9 Hrs)

HTML tags, Lists, Tables, Images, forms, Frames. Cascading style sheets. Introduction to Java script. Objects in Java Script. Dynamic HTML with Java Script

Learning Outcomes: At the end of this unit, students should be able to

- Create standard tags of HTML tags and Knowing the features of designing static web pages. (L6)
- List different types of CSS to design webpage attractively. (L1)
- Apply Java script concepts and create dynamic HTML pages. (L4)

UNIT – II (10 Hrs)

Working with XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how XML interacts with different applications. (L1)
- Examine background applications using XSL and XSLT. (L4)

UNIT – III (9 Hrs)

AJAX A New Approach: Introduction to AJAX, Integrating PHP and AJAX. Consuming WEB services in AJAX: (SOAP, WSDL, UDDI)

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of AJAX Architecture. (L2)
- Integrate and test web services. (L5)

UNIT – IV (9 Hrs)

PHP Programming: Introducing PHP: Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements, Arrays, functions. Working with forms and Database such as my Sql.

Learning Outcomes: At the end of this unit, students should be able to

- Develop PHP Programs using WAMP and XAMPP Server. (L3)
- Create a website with a Database (My SQL) in PHP. (L5)

UNIT – V (8 Hrs)

Introduction to PERL, Perl language elements, Interface with CGI- A form to mail program, Simple page search

Learning Outcomes: At the end of this unit, students should be able to

- Creating simple programs with PERL. (L4)
- Comparing CGI with other server-side technologies. (L5)

TEXTBOOKS:

1. "Programming the World Wide Web", Robert W Sebesta, Pearson Education, 7th Edition
2. "Web Technologies", Uttam K Roy, Oxford University Press
3. "The Web Warrior Guide to Web Programming", Bai, Ekedahl, Farrelll, Gosselin, Zak, Karparhi, Maclntyre, Morrissey, Cengage Learning

REFERENCES:

1. "Ruby on Rails Up and Running, Lightning fast Web development", Bruce Tate, Curt Hibbs, Oreilly Media Inc., 2006
2. "Programming Perl", Tom Christiansen, Jonathan Orwant, Oreilly Media Inc., 4th Edition, 2012

3. "Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX", Black book, Dream Tech.
4. "An Introduction to Web Design, Programming", Paul S Wang, Sanda S Katila, Cengage Learning.

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/html/
2. https://www.w3schools.com/js/
3. https://www.w3schools.com/xml/xml_whatis.asp
4. https://www.w3schools.com/php/

OPEN ELECTIVE – IV

Course Code	COST EFFECTIVE HOUSING TECHNIQUES		L	T	P	C
21A010504			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To train the students to have a comprehensive knowledge of planning, design, evaluation, construction
- To train the students to financing of housing projects
- To Provide Knowledge on cost effective construction materials and methods.
- To teach the principles of sustainable housing policies and programmes.

COURSE OUTCOMES:

At the end of the course, student will be able to

CO1: Understand about planning, design, evaluation, construction and financing of housing projects with cost effective housing techniques. **(K2)**

CO2: Choose the basic housing programmes and services and slum improvement and relocation. **(K3)**

CO3: The student can be in a position to adopt the suitable techniques in construction of low cost constructions. **(K6)**

CO4: Understand about alternate building materials for low cost housing techniques and sanitation services in rural areas. **(K2)**

CO5: The student can be in a position to analyze the suitable techniques in rural and disaster prone areas by using locally available materials. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

INTRODUCTION TO HOUSING: Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the about basics about housing norms. (L4)
- Understand the objectives and strategies of housing policies. (L2)

UNIT – II (9 Hrs)

HOUSING PROGRAMMES: Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate the usage of GIS and MIS in housing projects. (L4)
- Explain about development of plots and gated communities. (L4)

UNIT – III (9 Hrs)

DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY: Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements - Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall - Fly ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

Learning Outcomes: At the end of this unit, students should be able to

- Write about the adoption of Economical Wall System. (L6)
- Write about Adoption of precast R.C. plank and join system for roof/floor in the building. (L6)

UNIT – IV (9 Hrs)

ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING AND INFRASTRUCTURE SERVICES IN RURAL HOUSES: Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Low cost Infrastructure services: Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy. Rural Housing**:** Introduction traditional practice of rural housing continuous - Mud Housing technology-Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs.

Learning Outcomes: At the end of this unit, students should be able to

- Determine about alternate building materials for low cost housing construction. (L3)
- Justify about low cost sanitation from traditional methods. (L6)

UNIT – V (9 Hrs)

HOUSING IN DISASTER PRONE AREAS: Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirements of structural safety of thin pre-cost roofing units against Earthquake forces -Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about Type of Damages and Railways of non-engineered buildings. (L4)
- Express about Repair and restore action of earthquake Damaged structures and for future constructions. (L6)

TEXTBOOKS:

1. "Hand book of Low Cost Housing", A. K. Lal, New Age International publishers.
2. "Low Cost Housing", G.C. Mathur, IBH Publishers.
3. "Housing in India", Francis Cherunilam and Odeyar D Heggade, Himalaya Publishing House, Bombay, 1997.

REFERENCE BOOKS:

1. "Disaster Management", Rajib Shaw, Universities Press, India.
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Building Materials For Low–Income Houses", International Council For Building Research Studies And Documentation.
4. "Modern Trends In Housing In Developing Countries", A.G. Madhava Rao, D.S. Rama Chandra Murthy & G. Annamalai.
5. "Properties of Concrete"', Neville A.M. Pitman Publishing Limited, London.
6. "Light Weight Concrete", Academic Kiado, Rudhai.G, Publishing home of Hungarian Academy of Sciences, 1963.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/124107001
2. https://nptel.ac.in/courses/105103206
3. https://onlinecourses.nptel.ac.in/noc20_ar14/preview4

Course Code	ENERGY CONSERVATION AND MANAGEMENT		L	T	P	C
21A020507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Familiarize present energy scenario, and energy auditing methods.
- Explain components of electrical systems, lighting systems and improvements in performance. Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
- Train on energy conservation in major utilities.
- Instruct principles of energy management and energy pricing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain Energy Utilization and Energy Auditing Methods. **(K3)**

CO2: Analyse Electrical Systems Performance of Electric Motors and Lighting Systems. **(K4)**

CO3: Examine Energy Conservation Methods in Thermal Systems. **(K3)**

CO4: Estimate Efficiency of Major Utilities Such as Fans, Pumps, Compressed Air Systems, Havoc and D.G. Sets. **(K2)**

CO5: Elaborate Principles of Energy Management, Programs, Energy Demand and Energy Pricing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction: Energy – Power – Past & Present Scenario of World; National Energy Consumption Data – Environmental Aspects Associated with Energy Utilization –Energy Auditing: Need, Types, Methodology And Barriers. Role of Energy Managers, Instruments for energy auditing.

Learning Outcomes: At the end of this unit, students should be able to

- Infer energy consumption patterns and environmental aspects of energy utilization. (L4)
- Outline energy auditing requirements, tools, and methods. (L3)
- Identify the function of energy manager. (L2)

UNIT – II (9 Hrs)

Electrical Systems: Components of EB Billing – HT And LT Supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of Lighting, Efficacy, LED Lighting And Scope Of Economy In Illumination.

Learning Outcomes: At the end of this unit, students should be able to

- Outline components of electricity billing, transmission, and distribution. (L3)
- Analyse performance characteristics of transformers, capacitors, and electric motors. (L4)
- Examine power factor improvements, and electric motor efficiency. (L3)
- Evaluate lighting systems. (L4)

UNIT – III (9 Hrs)

Thermal Systems: Stoichiometry, Boilers, Furnaces, and Thermic Fluid Heaters – Efficiency Computation and Encon Measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, and Insulators & Refractory's.

Learning Outcomes: At the end of this unit, students should be able to

- Determine efficiency of boilers, furnaces, and other thermal systems. (L3)
- Recommend energy conservation measures in thermal systems. (L2)
- Justify steam systems in energy conservation. (L3)

UNIT – IV (9 Hrs)

Energy Conservation in Major Utilities: Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. Sets.

Learning Outcomes: At the end of this unit, students should be able to

- Explain energy conservation measures in major utilities. (L3)
- Apply performance test criteria for fans, pumps, compressors, havoc systems. (L3)
- Assess energy conservation in cooling towers and D.G. sets. (L3)

UNIT – V (9 Hrs)

Energy Management: Principles of Energy Management, Energy demand estimation, Organizing and Managing Energy Management Programs, Energy pricing.

Learning Outcomes: At the end of this unit, students should be able to

- Describe principles of energy management. (L2)
- Assess energy demand and forecast, organize energy management programs. (L3)
- Design elements of energy pricing. (L5)

TEXTBOOKS:

1. "Energy Manager Training Manual", A Website Administered by Bureau of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government of India, 2004, 4 Volumes Available at www.energymanagertraining.com

REFERENCE BOOKS:

1. "Industrial Energy Management and Utilisation", Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988.
2. "Design and Management for Energy Conservation", Callaghn, P.W., Pergamon Press, Oxford, 1981
3. "The Efficient Use of Energy", Dryden. I.G.C., Butter worths, London, 1982
4. "Energy Management", Murphy. W. R. and G. Mc Kay, Butter worths, London 1987

Course Code	BASICS OF POWER ELECTRONICS		L	T	P	C
21A020508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operation, characteristics, and usage of power semiconductor devices. **(K2)**
CO2: Understand different types of Rectifier circuits with different operating conditions. **(K2)**
CO3: Understand DC-DC converters operation and analysis of their characteristics. **(K2)**
CO4: Understand the construction and operation of voltage source inverters. **(K2)**
CO5: Apply all the above concepts to solve various numerical problem solving. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	1	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-	1	-

UNIT – I (9 Hrs)

Power Switching Devices: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

Learning Outcomes: At the end of this unit, students should be able to

- Know the V-I characteristics of different semi-conductor devices. (L4)
- Importance of drive circuit for MOSFET, IGBT and GTO. (L3)

UNIT – II (9 Hrs)

Rectifiers: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance.

Learning Outcomes: At the end of this unit, students should be able to

- Derivation of expressions of different configurations of rectifiers. (L3)

- Calculate the Average, R.M.S values of Voltages and Currents. (L4)

UNIT – III (8 Hrs)

DC-DC converters: Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of duty cycle. (L2)
- Analysis of waveforms at steady state of power circuit. (L4)
- Derivation of average output voltage of DC-DC converter. (L3)

UNIT – IV (9 Hrs)

Inverter: Single phase Voltage Source inverters– operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters –Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle operationally.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of pulse width modulation. (L2)
- Analysis of waveforms of single phase and three phase bridge inverters. (L4)

UNIT – V (10 Hrs)

AC voltage controllers & Cyclo converters: voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of TRIAC – TRIAC with R and RL loads– RMS load voltage, current and power actor-waveforms. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down Cyclo converters with Resistive load, Principle of operation, Waveforms, output voltage.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of the phase control and integral cycle control. (L2)
- Know the principal operation of voltage and frequency converter. (L4)
- Analysis waveforms of ac voltage converter and Cyclo converter. (L4)

TEXTBOOKS:

1. “Power Electronics: Circuits, Devices and Applications”, M. H. Rashid, Prentice Hall of India, 2nd Edition, 1998
2. “Power Electronics”, P. S. Bimbhra, Khanna Publishers, 4th Edition, 2010.
3. “Power Electronics”, M. D. Singh & K. B. Khanchandani, Tata Mc Graw Hill Publishing Company, 1998.

REFERENCE BOOKS:

1. "Power Electronics", Ned Mohan, Wiley, 2011
2. "Fundamentals of Power Electronics", Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004
3. "Power Electronics", Vedam Subramanyam, New Age International (P) Limited, 1996.
4. "Power Electronics", V. R. Murthy, Oxford University Press, 1st Edition, 2005.
5. "Power Electronics", P. C. Sen, Tata Mc Graw-Hill Education, 1987
6. "Power Electronic Control of Alternating Current Motors", J. M. D. Murphy.

Course Code	PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS		L	T	P	C
21A040507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyze cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts and operation of cellular systems. **(K2)**

CO2: Apply the concepts of co-channel interference & Cell splitting to solve engineering problems. **(K3)**

CO3: Compare different Handoffs. **(K4)**

CO4: Compare various types of multiple access techniques. **(K4)**

CO5: Evaluate suitability of a cellular system in real time applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	3

UNIT – I (10 Hrs)

Introduction to Cellular Mobile Systems: Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts and operation of cellular systems. (L2)
- Explain the characteristics of mobile radio environment. (L2)

UNIT – II (8 Hrs)

Cellular Radio System Design: General description of the problem, Concept of frequency reuse channels, Co-channel interference reduction, Desired C/I ratio, Cell splitting and sectoring, Microcell zone concept.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of frequency reuse and co-channel interference in cellular systems. (L2)
- Apply the concept of cellular systems to solve engineering problems. (L3)
- Explain the design problems of cellular systems. (L3)

UNIT – III (10 Hrs)

Handoffs and Dropped Calls: Why handoffs and types of handoffs, Initiation of handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Inter system handoff. Introduction to dropped call rate.

Learning Outcomes: At the end of this unit, students should be able to

- Understand why handoff is required. (L2)
- Apply handoff techniques to solve engineering problems. (L3)
- Compare various types of handoffs. (L4)

UNIT – IV (8 Hrs)

Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various types of multiple access techniques. (L2)
- Apply the concept of multiple access to solve engineering problems. (L3)
- Compare various types of multiple access techniques. (L4)

UNIT – V (9 Hrs)

Digital Cellular Systems: Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

Learning Outcomes: At the end of this unit, students should be able to

- Understand operation of various types of digital cellular systems. (L2)
- Compare various types of digital cellular systems. (L2)
- Evaluate suitability of a cellular system in real time applications. (L4)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Mobile Cellular Tele communications", William C.Y.Lee, McGraw – Hill International, 2nd Edition, 1995.
2. "Wireless Communications–Principles and Practice", Theodore S. Rappaport, PHI, 2nd Edition, 2004.

REFERENCE BOOKS:

1. "Principles of Modern Wireless Communications Systems –Theory and Practice", Aditya K. Jagannatham, McGraw – Hill International, 2015.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117102062
2. https://www.electronicshub.org/wireless-communication-introduction-types-applications/

Course Code	EMBEDDED SYSTEMS		L	T	P	C
21A040508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the basics of an embedded system
- To introduce the typical components of an embedded system
- To explain various communication interfaces used in embedded system
- To provide knowledge on the design process of embedded system applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Discuss the basic concepts of an embedded system. **(K3)**

CO2: Explainthe role of system core, memory, sensors, actuators, I/O and other sub system components in an embedded system. **(K3)**

CO3: Explain the different communication interfaces of an embedded system. **(K3)**

CO4: Illustrate about the interrupt service mechanism and device drivers. **(K3)**

CO5: Write aboutvarious steps involved in design and development of embedded firmware. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

Introduction to Embedded Systems: Definition, Embedded systems Vs General computing systems, History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

Learning Outcomes: At the end of this unit, students should be able to

- Classify embedded systems based on generation, complexity and performance. (L2)
- Discuss the characteristics of an embedded system. (L2)
- Explain the design process in embedded system. (L3)

UNIT – II (9 Hrs)

Typical Embedded System: Core of the embedded system, Memory-ROM, RAM, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer, PCB and passive components

Learning Outcomes: At the end of this unit, students should be able to

- Discuss about the core of the embedded system. (L2)
- Summarize different factors to be considered in the selection of memory for an embedded system. (L2)
- Explain the role of sensors, actuators, I/O components and other subsystem components used in embedded system. (L3)

UNIT – III (9 Hrs)

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various types of on-board communication interfaces. (L3)
- Describe the external communication interfaces used in embedded system. (L2)
- Discuss the different types of wireless communication interfaces used in embedded system. (L2)

UNIT – IV (9 Hrs)

Device drivers and Interrupt Service Mechanism: Programmed I/O busy-wait approach without interrupt service mechanism, Interrupt-driven I/O, interrupt service routine concept, interrupt sources, hardware interrupts, software interrupts, interrupt-servicing mechanism, multiple interrupts, interrupt service threads as second-level interrupt handlers, context and the periods for context switching, interrupt latency, interrupt-service deadline, interrupt service mechanism form context-saving angle, Device driver programming.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize pros and cons of interrupt driven data transfer. (L2)
- Illustrate hardware and software interrupts with examples. (L3)
- Know how interrupts can be used to minimize latency. (L3)
- Describe uses of hardware and software assigned priorities in an interrupt service mechanism. (L2)
- Differentiate ISRs & device driver functions. (L2)

UNIT – V (8 Hrs)

Embedded Firmware Design and Development: Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the different approaches for embedded firmware design. (L2)
- Discuss the different embedded firmware development languages. (L2)
- Explain the process of Assembly language to machine language conversion and High-level language to machine language conversion. (L3)
- Write aboutvarious steps involved in design and development of embedded firmware. (L3)

TEXTBOOKS:

1. "Introduction to Embedded Systems", Shibu. K.V., McGraw Hill Education, 2nd Edition, 2017.
2. "Embedded Systems: Architecture, Programming and Design", Raj Kamal, McGraw Hill Education, 3rd Edition, 2017

REFERENCE BOOKS:

1. "Computers as Components", Wayne Wolf, Morgan Kaufmann, Elsevier, 2nd Edition
2. "Embedded Systems- An integrated approach", Lyla B Das, Pearson education, 2012
3. "Embedded Microcomputer Systems Real Time Interfacing", Jonathan W.Valvano, Cengage Learning, 3rd Edition, 2012.

Course Code	CLOUD COMPUTING – AWS		L	T	P	C
21A050507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Define cloud services and models
- Demonstrate design the architecture for new cloud application.
- Explain how to re-architect the existing application for the cloud

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the procedure for Cloud deployment. **(K3)**
CO2: Distinguish different cloud service models and deployment models. **(K3)**
CO3: Compare different cloud services. **(K4)**
CO4: Implementation of various services in cloud environment. **(K5)**
CO5: Design applications for an organization which use cloud environment. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	2	1	-	-	1	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-	2	2
CO4	3	-	2	-	-	-	-	-	3	-	-	-	-	2
CO5	3	-	2	-	-	-	-	-	3	-	-	-	-	2

UNIT – I (9 Hrs)

Introduction to Cloud Computing: Introduction to Cloud Computing, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the Cloud characteristics and models. (L2)
- Classify different models, different technologies in cloud. (L2)

UNIT – II (9 Hrs)

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and Management Services, Identity and Access Management Services, Open Source Private Cloud

Software, Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the Services and Platform of cloud. (L2)
- Demonstrate Hadoop Cluster Setup. (L2)

<u>UNIT – III</u> (9 Hrs)

Cloud Application Design: Design Considerations, Reference Architectures, Cloud Application Design Methodologies, Data Storage Approaches, Multimedia Cloud: Introduction, Case Study: Live Video Streaming App, Streaming Protocols, Case Study: Video Transcoding APP.

Learning Outcomes: At the end of this unit, students should be able to

- Design and build cloud applications. (L6)
- Describe the multimedia cloud. (L2)

<u>UNIT – IV</u> (10 Hrs)

Python for Amazon Web Services: Python for Amazon Web Services, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.

Learning Outcomes: At the end of this unit, students should be able to

- Select different cloud services from different vendors. (L2)
- Utilize Python language to access cloud services. (L3)

<u>UNIT – V</u> (8 Hrs)

Case Study: Various Web Applications - Cloud Application Development in Python, Design Approaches, Image Processing APP, Document Storage App, Social Media Analytics App, Cloud Application Benchmarking and Tuning, Cloud Security, Cloud Computing for Education.

Learning Outcomes: At the end of this unit, students should be able to

- Investigate different Cloud applications. (L4)
- Design cloud applications using Python. (L6)

<u>TEXTBOOKS</u>:

1. "Cloud Computing: A Hands-on Approach", Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

<u>REFERENCE BOOKS:</u>

1. "Azure in Action", Chris Hay, Brian Prince, Manning Publications [ISBN: 9781935182481], 2010.
2. "Introducing Windows Azure" Henry Li, Apress, 1st Edition [ISBN: 978-14302-2469-3], 2009.

Course Code	BASICS OF CRYPTOGRAPHY & NETWORK SECURITY		L	T	P	C
21A050508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand essential building blocks and basic concepts of cyber security
- Explore Web security and Network security
- Explain the measures for securing the networks and cloud
- Understand privacy principles and policies
- Describe the legal issues and ethics in computer security

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection. **(K3)**

CO2: Assess the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure. **(K4)**

CO3: Identify the nature of secure software development and operating systems. **(K3)**

CO4: Demonstrate the role security management in cyber security defense. **(K2)**

CO5: Adapt the legal and social issues at play in developing solutions. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	2
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Vulnerabilities, threats and. Counter measures for computer security. (L2)
- Interpret the design of the malicious code. (L2)

UNIT – II (9 Hrs)

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Root kit.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the attacks on browser, Web and email. (L2)
- Explain the security aspects of Operating Systems. (L3)

UNIT – III (9 Hrs)

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management.

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network security threats and attacks. (L3)
- Design the Counter measures to defend the network security attacks. (L4)
- Analyze the security tools and techniques for Cloud computing. (L4)

UNIT – IV (9 Hrs)

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster

Learning Outcomes: At the end of this unit, students should be able to

- Interpret the need for Privacy and its impacts of Emerging Technologies. (L2)
- Explain how to handle incidents and deal with Disaster. (L2)

UNIT – V (8 Hrs)

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

Learning Outcomes: At the end of this unit, students should be able to

- Adapt legal issues and ethics in computer security. (L4)
- Elaborate on the Emerging topics. (L4)

TEXTBOOKS:

1. "Security in Computing", Charles P. Fleeger, Prentice Hall, 5th Edition, 2010.
2. "Applied Cryptography", Bruce Schneier, John Wiley & Sons, 2nd Edition,1996

REFERENCE BOOKS:

1. "Information Security: The Complete Reference", Mark Rhodes-Ousley, 2nd Edition,
2. "Information Security Management: Concepts and Practice", McGraw-Hill, 2013.
3. "Roadmap to Information Security for IT and Infosec Managers", Michael E. Whitman and Herbert J. Mattord, Boston, MA: Course Technology, 2011

ONLINE LEARNING RESOURCES:

1. https://www.geeksforgeeks.org/cryptography-and-network-security-principles
2. https://onlinecourses.nptel.ac.in/noc22_cs90/preview

HONOURS

Course Code	GEAR ENGINEERING		L	T	P	C
21A03HN01			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To introduce all varieties of Circuit Breakers and Relays for protection of Generators, Transformers and feeder bus bars from over voltages and other hazards.
- To emphasize on Neutral grounding for overall protection.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design and analyze spur gear using different theories and loading condition. **(K4)**
CO2: Design and analyze helical gear using different theories and loading condition. **(K4)**
CO3: Design and analyze Bevel gear using different theories and loading condition. **(K4)**
CO4: Design and analyze worm gear using different theories and loading conditions. **(K4)**
CO5: Design and analyze gear train using different theories and loading condition. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	3	-	-	-	-	-	-	2	2	2
CO2	3	3	2	1	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	2

UNIT – I (12 Hrs)

Introduction: Principles of gear tooth action, Generation of Cycloid and Involute gears, Involutometry, gear manufacturing processes and inspection, gear tooth failure modes, stresses, selection of right kind of gears.

Spur Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of spur gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

Learning Outcomes: At the end of this unit, students should be able to

- Know the principles of gear tooth action and selection of gears. (L1)
- Analyze and design of spur gear using theories. (L5)

UNIT – II (8 Hrs)

Helical Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of helical gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

Learning Outcomes: At the end of this unit, students should be able to

- Know the geometry of gear tooth and principles. (L1)
- Analyze and design of helical gear using theories. (L5)

UNIT – III (8 Hrs)

Bevel Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of bevel gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

Learning Outcomes: At the end of this unit, students should be able to

- Know the geometry of gear tooth and principles. (L1)
- Analyze and design of bevel gear using theories. (L5)

UNIT – IV (12 Hrs)

Worm Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of worm gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Heat dissipation considerations. Design of gear shaft and bearings.

Gear failures: Analysis of gear tooth failures, Nomenclature of gear tooth wear and failure, tooth breakage, pitting, scoring, wear, overloading, gear-casing problems, lubrication failures

Learning Outcomes: At the end of this unit, students should be able to

- Know the geometry of gear tooth and principles. (L1)
- Analyze and design of worm gear using theories. (L5)

UNIT – V (12 Hrs)

Gear trains: Simple, compound and epicyclic gear trains, Ray diagrams, Design of a gear box of an automobile, Design of gear trains from the propeller shafts of airplanes for auxiliary systems.

Optimal Gear design: Optimization of gear design parameters, Weight minimization, Constraints in gear train design-space, interference, strength, dynamic considerations, rigidity etc. Compact design of gear trains, multi objective optimization of gear trains. Application of Traditional and non-traditional optimization techniques

Learning Outcomes: At the end of this unit, students should be able to

- Know the types of gear trains used in different systems. (L1)
- Design of Gear train using different optimization techniques. (L5)

TEXTBOOKS:

1. "Machine Design", Maleev and Hartman, C.B.S. Publishers, India.
2. "Gear engineering", Henry E. Merrit, Wheeler publishing, Allahabad,1992.
3. "Practical Gear design", Darle W. Dudley, McGraw-Hill book company

REFERENCE BOOKS:

1. "Analytical mechanics of gears", Earle Buckingham, Dover publications, New York, 1949.
2. "Hand book of gear design", G. M. Maitha, Tata McGraw Hill publishing company Ltd., NewDelhi,1994.

Course Code	FRACTURE FATIGUE AND CREEP DEFORMATION		L	T	P	C
21A03HN02			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- Provide an understanding of the mechanics and micro-mechanisms of elastic and plastic deformation, creep, fracture, and fatigue failure, as applied to metals, ceramics, composites, thin film and biological materials.
- Provide a thorough introduction to the principles of fracture mechanics.
- Provide practical examples of the application of fracture mechanics to design and life prediction methods and reporting.
- Provide a basis for the use of fractography as a diagnostic tool for structural failures.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the failure pattern and study of intensity of failure. **(K2)**
CO2: Analysis of failure of linear elastic materials under plastic zone region. **(K4)**
CO3: Study of micro mechanism and factors that tends to failure of EPFM materials. **(K2)**
CO4: Analyze the failure and life prediction when material subjected repeated load. **(K4)**
CO5: Use creep data to predict the life of structures at elevated temperatures. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	1	-	-	-	-	-	-	2	2	2
CO2	3	3	1	1	1	-	-	-	-	-	-	2	2	2
CO3	3	3	1	3	1	-	-	-	-	-	-	2	2	2
CO4	3	3	1	3	1	-	-	-	-	-	-	2	2	2
CO5	3	3	1	3	1	-	-	-	-	-	-	2	2	2

UNIT – I (12 Hrs)

Introduction: Prediction of mechanical failure. Macroscopic failure modes; brittle and ductile behaviour. Fracture in brittle and ductile materials – characteristics of fracture surfaces; inter-granular and intra-granular failure, cleavage and micro-ductility, growth of fatigue cracks, The ductile/brittle fracture transition temperature for notched and unnotched components. Fracture at elevated temperature.

Griffiths analysis: Concept of energy release rate, G, and fracture energy, R. Modification for ductile materials, loading conditions. Concept of R curves.

Learning Outcomes: At the end of this unit, students should be able to

- Know the pattern under different failure modes (L1)
- Analyze the failure intensity using Griffiths theory.(L5)

UNIT – II (12 Hrs)

Linear Elastic Fracture Mechanics, (LEFM). Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor.

The effect of Constraint, definition of plane stress and plane strain and the effect of component thickness. The plasticity at the crack tip and the principles behind the approximate derivation of plastic zone shape and size. Limits on the applicability of LEFM.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the failure behavior in linear elastic materials. (L4)

UNIT – III (12 Hrs)

Elastic-Plastic Fracture Mechanics; (EPFM). The definition of alternative failure prediction parameters, Crack Tip Opening Displacement, and the J integral. Measurement of parameters and examples of use.

The effect of Microstructure on fracture mechanism and path, cleavage and ductile failure, factors improving toughness

Learning Outcomes: At the end of this unit, students should be able to

- Know the parameters to know the micro structural failure. (L4)

UNIT – IV (12 Hrs)

Fatigue: definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, mean stress R ratio, strain and load control. S-N curves. Goodmans rule and Miners rule. Micromechanisms of fatigue damage, fatigue limits and initiation and propagation control, leading to a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction.

Learning Outcomes: At the end of this unit, students should be able to

- Know the kind of failure that causes due to repeated loading conditions. (L4)

UNIT – V (10 Hrs)

Creep deformation: the evolution of creep damage, primary, secondary and tertiary creep. Micro- mechanisms of creep in materials and the role of diffusion. Ashby creep deformation maps. Stress dependence of creep – power law dependence. Comparison of creep performance under different conditions – extrapolation and the use of Larson-Miller

Learning Outcomes: At the end of this unit, students should be able to

- Understand mechanisms of creep deformation and fracture. (L4)

TEXTBOOKS:

1. "Fracture Mechanics Fundamentals and Applications", T.L. Anderson, 2nd Ed. CRC press, (1995)

2. "Fracture of Brittle Solids", B. Lawn, Cambridge Solid State Science Series 2nd edition, 1993.
3. "Fundamentals of Fracture Mechanics", J.F. Knott, Butterworths (1973)
4. "Worked examples in Fracture Mechanics", J.F. Knott, P Withey, Institute of Materials.

REFERENCE BOOKS:

1. "Fracture Mechanics", Edward Arnold (1984)
2. "Fatigue of Materials", S. Suresh, H.L. Ewald and R.J.H. Wanhill Cambridge University Press (1998).
3. "Thin Film Materials", L.B. Freund and S. Suresh, Cambridge University Press (2003)
4. "Mechanical Metallurgy", G. E. Dieter, McGraw Hill (1988)
5. "Inelastic Deformation of Metals", D.C. Stouffer and L.T. Dame, Wiley (1996)
6. "The Physics of Creep", F.R.N. Nabarro, H.L. deVilliers, Taylor and Francis (1995)

Course Code	INDUSTRIAL ROBOTICS & EXPERT SYSTEMS		L	T	P	C
21A03HN03			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand the process of designing a robot.
- To give students a real-life experience on what it takes to be a professional engineer.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the kinematics and working principles of robotics in industries.**(K2)**
CO2: Understand the drives and sensing device used in control and robotics.**(K2)**
CO3: Understand the importance of robotic sensors in image processing and recognition**(K2)**
CO4: Know the work environment in the industries and its interface with robotics.**(K2)**
CO5: Know the robot programming and optimization method to develop an application for industry. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	3	-	-	-	-	-	-	3	2	2
CO2	3	3	2	1	3	-	-	-	-	-	-	3	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	3	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	3	2	2

UNIT – I (12 Hrs)

INTRODUCTION AND ROBOT KINEMATICS: Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

Learning Outcomes: At the end of this unit, students should be able to

- Familiarize with robot structures, their workspace and kinematics involved. (L1)

UNIT – II (10 Hrs)

ROBOT DRIVES AND CONTROL: Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

Learning Outcomes: At the end of this unit, students should be able to

- Know types of sensing and drivers used in robotics. (L1)

UNIT – III (10 Hrs)

ROBOT SENSORS: Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

Learning Outcomes: At the end of this unit, students should be able to

- Know types of sensors and its applications in system. (L2)

UNIT – IV (8 Hrs)

ROBOT CELL DESIGN AND APPLICATION: Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.

Learning Outcomes: At the end of this unit, students should be able to

- Know the work layouts and interfaces. (L2)

UNIT – V (10 Hrs)

ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS: Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Learning Outcomes: At the end of this unit, students should be able to

- Know the robot programming to develop and application for industry. (L2)

TEXTBOOKS:

1. "Robotics Control, Sensing, Vision and Intelligence", K.S.Fu, R.C. Gonzalez and C.S.G. Lee, Mc Graw Hill, 1987.

REFERENCES:

1. "Robotics for Engineers", Yoram Koren," Mc Graw-Hill,1987.
2. "Industrial Robots", Kozyrey, Yu. MIR Publishers Moscow,1985.
3. "Robotics Engineering – An Integrated Approach", Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, Prentice-Hall of India Pvt. Ltd., 1984.
4. "Robotics Technology and Flexible Automation", Deb, S.R. Tata Mc Graw-Hill,1994.
5. "Industrial Robotics Technology, Programming and Applications", Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey,Mc Graw-Hill, Int.1986.
6. "Expert Systems and Robotics", Timothy Jordanides et al, Springer –Verlag, New York, May1991.

Course Code	APPLIED ENGINEERING ACOUSTICS		L	T	P	C
21A03HN04			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To impart knowledge on the fundamentals of acoustics, its characteristics, its transmission in different media, usage of sound measuring instruments and the various sound control methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concept of sound and types which cause for acoustics.**(K2)**
CO2: Study the sound wave propagation in 1D and 2D solids and its interface.**(K2)**
CO3: Study the sound wave propagation in different mediums and its interface.**(K2)**
CO4: Study the sound intensity and its amplitude and frequency using different methods**(K2)**
CO5: Understand difference in sound and noise ,noise reduction techniques that causes acoustics **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	2	-	-	-	-	-	-	1	2	2
CO2	3	3	2	3	2	-	-	-	-	-	-	1	2	2
CO3	3	3	3	3	1	-	-	-	-	-	-	1	2	2
CO4	3	3	3	3	1	-	-	-	-	-	-	1	2	2
CO5	3	3	3	3	1	-	-	-	-	-	-	1	2	2

UNIT – I (10 Hrs)

BASIC CONCEPTS OF ACOUSTICS: Scope of Acoustics – Sound pressure – Sound intensity – Sound power level Sound power– Wave motion – Alteration of wave paths – Measurement of sound waves – sound spectra– Sound fields – Interference – Standing waves – Acoustic energy density and intensity – Specific acoustic impedance.

Learning Outcomes: At the end of this unit, students should be able to

- Know the sound waves that cause the acoustics. (L1)

UNIT – II (12 Hrs)

CHARACTERISTICS OF SOUND: One dimensional wave equation – Solution of 1D wave equation – Velocity in gaseous medium – Velocity of plane progressive sound wave through a thin solid rod – Velocity of plane wave in a bulk of solid – Transverse wave propagation along a string stretched under tension – Wave equation in two dimension.

Learning Outcomes: At the end of this unit, students should be able to

- Know about sound propagation in different solids under loading condition. (L1)

UNIT – III (12 Hrs)

TRANSMISSION PHENOMENA: Changes in media – Transmission from one fluid medium to another, normal incidence, oblique incidence - Reflection at the surface of a solid, normal incidence, oblique incidence – Standing wave pattern – Transmission through three media.

Learning Outcomes: At the end of this unit, students should be able to

- Know transmission in different mediums and their impact of reflection of sound wave. (L2)

UNIT – IV (12 Hrs)

INTRODUCTION TO THE ASSESSMENT AND MEASUREMENT OF SOUND: Introduction – Decibel scale for the measurement of sound power – Sound level meter – Weighted sound pressure level – Equal Loudness contours – Perceived noisiness – Loudness, Loudness level, perceived noise, perceived noise level – Equivalent sound level– Identified level – Frequency and Amplitude measurement.

Learning Outcomes: At the end of this unit, students should be able to

- Know different devices used to observe the intensity of sound wave. (L2)

UNIT – V (10 Hrs)

BASICS OF NOISE CONTROL: Noise Control at source, path, receiver – Noise control by acoustical treatment – Machinery noise – Types of machinery involved – Determination of sound power and sound power level – Noise reduction procedures – Acoustic enclosures.

Learning Outcomes: At the end of this unit, students should be able to

- Know technique of noise reduction in machines. (L2)

TEXTBOOKS:

1. "Fundamentals of Acoustics", Lawrence E. Kinsler, Austin R. Frey, John Wiley and Sons Inc.,1986.
2. "Engineering Noise Control – Theory and Practice", Bies, David, A. and Hansen, Colin H., E and FN Spon, Chapman-Hall, Second Edition,1996.
3. "Active Control of Sound and Vibration", Hansen C.H. and Snyder, S.D., E and FN Spon, London1996

ELECTRONICS AND COMMUNICATION ENGINEERING
(For the batches admitted from the academic year 2021-22)

Vision

- To produce technically competent and research-oriented Electronics and Communication Engineers to meet the Industrial and Social requirements.

Mission

- To impart quality technical education in the field of Electronics and Communication Engineering through state-of-the art facilities and effective teaching learning process.
- To enrich the faculty and students with research and consultancy skills through Industry-Interaction and Training in Emerging areas of Electronics and Communication Engineering.
- To develop lifelong learning, leadership qualities and ethical values in learners to meet the societal and industrial needs.

Institutional Objectives

- To create a conducive and competitive environment for students through curricular and extra-curricular activities.
- Promote the culture of research among the faculty.
- To promote synergetic alliances with premier Institutions, Industry, CSIR laboratories and various Government organizations for Collaborative Research Projects.
- To promote economic and social enrichment of the society through Skill Development programmes, Entrepreneurship, and extension activities.
- To introduce demand-driven new UG&PG academic programmes.
- To ensure a high degree of quality in terms of providing infrastructure, research ambience, faculty and staff development.

Core Values

- *Thirst for Quality Education:* The stake holders of the institute particularly management, employees and students of the institution have a consistent thirst for quality improvement of the processes and services in the institution.
- *Lifelong Learning:* In the fast-changing technological world, acquiring a special skill at one point of time will not be enough for ever long survival. Hence to flourish in the workplace and to bring in innovations in the ways of doing, employee, student as well as alumni must be continuous learners and tech savvy.

- *Diversity and Participation:* PBRVITS promotes the involvement of faculty, staff, and students from all social, economic, ethnics, cultural and religious backgrounds to get the synergy of combining the diversified agents. The focus is on involving students to exhibit their talent in various curricular and co-curricular activities and strengthening alumni link to share their experiences to the students.
- *Academic Integrity and Accountability:* Management induces accountability in the employees for the career of the students and the academic leadership establishes a mentoring mechanism for realization of responsibilities of students towards their parents and in turn to the society.

ELECTRONICS AND COMMUNICATION ENGINEERING
(For the batches admitted from the academic year 2021-22)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept./Branch & Innovations

Semester I (First Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110101	Calculus and Special Functions	3	0	0	3	30	70	100
2	BS	21A110102	Mathematical Methods	3	0	0	3	30	70	100
3	ES	21A020301	Fundamentals of Electrical Circuits	3	0	0	3	30	70	100
4	ES	21A050302	C Programming & Data Structures	3	0	0	3	30	70	100
5	ES	21A030301	Engineering Drawing	1	0	4	3	30	70	100
6	ES	21A020302	Fundamentals of Electrical Circuits Lab	0	0	3	1.5	30	70	100
7	ES	21A050303	C Programming & Data Structures Lab	0	0	3	1.5	30	70	100
8	HSMC	21A110201	Communicative English Lab	0	0	2	1	30	70	100
Total							**19**			**800**

Semester II (First Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110103	Differential Equations & Vector Calculus	3	0	0	3	30	70	100
2	BS	21A110104	Applied Physics	3	0	0	3	30	70	100
3	BS	21A110105	Applied Chemistry	3	0	0	3	30	70	100
4	HSMC	21A110202	English for Professionals	2	0	0	2	30	70	100
5	ES	21A040301	Electronic Devices & Circuits	3	0	0	3	30	70	100
6	BS	21A110108A	Applied Physics Lab	0	0	3	1.5	30	70	100
7	BS	21A110108B	Applied Chemistry Lab	0	0	3	1.5	30	70	100
8	ES	21A050301	Engineering & IT Workshop Lab	0	0	3	1.5	30	70	100
9	ES	21A040302	Electronic Devices & Circuits Lab	0	0	3	1.5	30	70	100
10	MC	21A000001	Environmental Science	2	0	0	0	30	---	---
Total							**20**			**900**

Semester III (Second Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110112	Complex Variables and Transforms	3	0	0	3	30	70	100
2	PC	21A040401	Signals & Systems	3	0	0	3	30	70	100
3	PC	21A040402	Pulse and Digital Circuits	3	0	0	3	30	70	100
4	PC	21A040403	Probability Theory and Stochastic Process	3	0	0	3	30	70	100
5	ES	21A020305	Electrical Technology	3	0	0	3	30	70	100
6	PC	21A040404	Pulse and Digital Circuits Lab	0	0	3	1.5	30	70	100
7	PC	21A040405	Basic Simulation Lab	0	0	3	1.5	30	70	100
8	ES	21A020306	Electrical Technology Lab	0	0	3	1.5	30	70	100
9	SC	21A050701	Python Programming	1	0	2	2	30	70	100
10	MC	21A000002	Constitution of India	2	0	0	0	30	-	-
Total							**21.5**			**900**

Semester IV (Second Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	ES	21A040303	Control Systems	3	0	0	3	30	70	100
2	HSMC	21A110203	Managerial Economics & Financial Analysis	3	0	0	3	30	70	100
3	PC	21A040406	Digital System Design	3	0	0	3	30	70	100
4	PC	21A040407	Electronic Circuit Analysis & Design	3	0	0	3	30	70	100
5	PC	21A040408	Analog Communications	3	0	0	3	30	70	100
6	PC	21A040409	Digital System Design Lab	0	0	3	1.5	30	70	100
7	PC	21A040410	Electronic Circuit Analysis & Design Lab	0	0	3	1.5	30	70	100
8	PC	21A040411	Analog Communications Lab	0	0	3	1.5	30	70	100
9	SC	21A040701	PCB Design	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship-I (Community Service Project) during semester break										

Semester V (Third Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A040412	Electromagnetic Waves and Transmission Lines	3	0	0	3	30	70	100
2	PC	21A040413	Integrated Circuits and Applications	3	0	0	3	30	70	100
3	PC	21A040414	Digital Communications	3	0	0	3	30	70	100
4	OE-I		**Open Elective - I**	3	0	0	3	30	70	100
5	PE-1	21A040415 21A040416 21A040417	**Professional Elective - I** a) Data Communication and Networking b) Electronic Measurement and Instrumentation c) Concepts of Machine Learning	3	0	0	3	30	70	100
6	PC	21A040418	Integrated Circuits and Applications Lab	0	0	3	1.5	30	70	100
7	PC	21A040419	Digital Communications Lab	0	0	3	1.5	30	70	100
8	SC	21A040702	Programming Arduino	1	0	2	2	30	70	100
9	MC	21A000003	Universal Human Values	3	0	0	3	30	70	100
10	PROJ	21A040601	Internship - I Evaluation	-	-	-	1.5	--	--	100
Total							**24.5**			**1000**

Semester VI (Third Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A040420	Antennas & Microwave Engineering	3	0	0	3	30	70	100
2	PC	21A040421	Microprocessors and Microcontrollers	3	0	0	3	30	70	100
3	PC	21A040422	Digital Signal Processing	3	0	0	3	30	70	100
4	PE - II	21A040423 21A040424 21A040425	**Professional Elective -II** a) Optical Communications b) Smart Sensors c) VLSI Design	3	0	0	3	30	70	100
5	OE - II		**Open Elective -II**	3	0	0	3	30	70	100
6	PC	21A040426	Antennas & Microwave Engineering Lab	0	0	3	1.5	30	70	100
7	PC	21A040427	Microprocessors and Microcontrollers Lab	0	0	3	1.5	30	70	100
8	PC	21A040428	Digital Signal Processing Lab	0	0	3	1.5	30	70	100
9	SC	21A040703	RF System Design	1	0	2	2	30	70	100
10	MC	21A000004	Research Methodology	2	0	0	0	30	---	---
Total							**21.5**			**900**
Internship –II (Industry) during semester break										

Semester VII (Fourth Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PE - III	21A040429 21A040430 21A040431	**Professional Elective -III** a) Embedded System Design b) DSP Processors and Architecture c) Satellite Communications	3	0	0	3	30	70	100
2	PE - IV	21A040432 21A040433 21A040434	**Professional Elective-IV** a) Cellular & Mobile Communication b) Biomedical Signal Processing c) Radar Engineering	3	0	0	3	30	70	100
3	PE - V	21A040435 21A040436 21A040437	**Professional Elective -V** a) Digital Image Processing b) Advanced Microprocessors c) Nano Electronics	3	0	0	3	30	70	100
4	OE - III		**Open Elective – III**	3	0	0	3	30	70	100
5	OE - IV		**Open Elective – IV**	3	0	0	3	30	70	100
6	HSMC	21A110204	Management Science	3	0	0	3	30	70	100
7	SC	21A050707	Software Testing Tools	1	0	2	2	30	70	100
8	PROJ	21A040602	Internship-II Evaluation	-	-	-	3	--	--	100
Total							**23**			**800**

Semester VIII (Fourth Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PROJ	21A040603	Full Internship & Major Project	-	-	12	10	110	140	250
2	PROJ	21A040604	Technical Seminar	-	-	4	2	50	-	50
Total							**12**			**300**

Open Elective – I

S. No	Course Code	Course Title
1	21A010501	Air Pollution and Control
2	21A020501	Electric Vehicles
3	21A020502	Electrical Distribution Systems
4	21A030501	Robotics
5	21A030502	Basics of Mechanical Engineering
6	21A050501	Operating Systems Concepts
7	21A050502	Computer Architecture & Organization

Open Elective – II

S. No	Course Code	Course Title
1	21A010502	Environmental Pollution and Control
2	21A020503	Smart Grid
3	21A020504	Energy Storage Systems
4	21A030503	Automation in Industries
5	21A030504	Rapid Prototyping
6	21A050503	Java Programming
7	21A050504	Basics of Database Management Systems

Open Elective – III

S. No	Course Code	Course Title
1	21A010503	Disaster Management and Mitigation
2	21A020505	Renewable Energy Systems
3	21A020506	Concepts of Electrical Drives and Applications
4	21A030505	Optimization Techniques
5	21A030506	Global Warming and Climate Changes
6	21A050505	Introduction to Internet of Things
7	21A050506	Web Technologies for Beginners

Open Elective – IV

S. No	Course Code	Course Title
1	21A010504	Cost Effective Housing Techniques
2	21A020507	Energy Conservation and Management
3	21A020508	Basics of Power Electronics
4	21A030507	Basics of Automotive Engineering
5	21A030508	Basics of Total Quality Management
6	21A050507	Cloud Computing - AWS
7	21A050508	Basics of Cryptography & Network Security

COURSES OFFERED FOR HONOURS DEGREE IN ECE

S. No	Course Code	Course Title	Hours per week		Credits	CIE	SEE	Total
			L	T	C			
1	21A04HN01	Advanced MOSFET Modeling	3	1	4	30	70	100
2	21A04HN02	VLSI Signal Processing	3	1	4	30	70	100
3	21A04HN03	CAD for VLSI	3	1	4	30	70	100
4	21A04HN04	Test and Testability	3	1	4	30	70	100
5	21A04HN05	MOOC – 1	-	-	2	-	-	-
6	21A04HN06	MOOC – 2	-	-	2	-	-	-

LIST OF MINORS OFFERED TO ECE

S. No	Course Code	Course Title	Department offering the course
1	21A050415	Design and Analysis of Algorithms	CSE & ALLIED
2	21A050418	Mobile Computing	CSE & ALLIED
3	21A310402	Artificial Intelligence and Neural Networks	CSE & ALLIED
4	21A350401	Sensors and Internet of Things	CSE & ALLIED

Course Code	CALCULUS AND SPECIAL FUNCTIONS (Common to all branches)		L	T	P	C
21A110101			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course will illuminate the students in the concepts of calculus and Mean value theorems.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Utilize mean value theorems to real life problems.
CO2: Familiarize with functions of several variables which is useful in optimization.
CO3: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems.
CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 3- dimensional coordinate systems.
CO5: Utilize special functions in evaluating definite integrals.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (10 Hrs)

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT – II (12 Hrs)

Multi variable calculus: Partial derivatives, total derivatives, chain rule, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes: At the end of this unit, students should be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

<u>UNIT – III</u> (10 Hrs)

Double Integrals: Evaluation of Double integrals, change of order of integration, change of variables. Areas using Double Integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

<u>UNIT – IV</u> (10 Hrs)

Triple Integrals: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volumes using triple integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate triple integrals in Cartesian, cylindrical and spherical polar coordinates. (L5)
- Apply triple integration techniques in evaluating volumes. (L4)

<u>UNIT – V</u> (12 Hrs)

Beta and Gamma functions: Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

<u>TEXTBOOKS</u>:

1. "Higher Engineering Mathematics", S. Grewal, Khanna Publishers, 44/e, 2017.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.

<u>REFERENCE BOOKS:</u>

1. "Advanced Engineering Mathematics", R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.

2. "Calculus", George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
3. "Advanced Modern Engineering Mathematics", Glyn James, Pearson publishers, 4/e, 2011.
4. "Advanced Engineering Mathematics", Michael Greenberg, Pearson Education, 9th Edition.
5. "Advanced Engineering Mathematics with MATLAB", Dean G. Duffy, CRC Press
6. "Advanced Engineering Mathematics", Peter O'Neil, Cengage Learning.
7. "Engineering Mathematics Volumes-I &II", R.L. Garg Nishu Gupta, Pearson Education
8. "Higher Engineering Mathematics", B. V. Ramana, McGraw Hill Education
9. "Higher Engineering Mathematics", H. K. Das, Er. Rajnish Verma, S. Chand & Co. Ltd.
10. "Advanced Engineering Mathematics", N. Bali, M. Goyal, C. Watkins, Infinity Science Press.
11. "Engineering Mathematics", T.K.V Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications.

Course Code	MATHEMATICAL METHODS (Common to all branches)		L	T	P	C
21A110102			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course aims at providing use of matrix algebra techniques for practical applications.
- This course aims at providing the student with the knowledge on Various numerical Methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop the use of matrix algebra techniques that is needed by engineers for practical applications.

CO2: Understand and solve the roots of equation using Bisection method, Iterative method, Regula-Falsi method, Newton Raphson method and solve the system of algebraic equations.

CO3: Apply concept of interpolation and derive interpolating polynomial using Newton's forward and backward formulae, Lagrange's formulae, Gauss forward and backward formulae.

CO4: Solving initial value problems to ordinary differential equations.

CO5: Determine the process of finding integral equations using Simson's 1/3, Simson's 3/8 Rule and Trapezoidal rule and fitting a best curve using least squares method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1	-

UNIT - I (10 Hrs)

Matrices: Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their Properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Diagonalization of a matrix.

Learning Outcomes: At the end of this unit, students should be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT - II (10 Hrs)

Solution of Algebraic & Transcendental Equations: Introduction-Bisection method-Iterative method-Regula-Falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan Method-Gauss Seidal method.

Learning outcomes: At the end of this unit, students should be able to

- Calculate the roots of equation using Bisection method and Iterative method. (L3)
- Calculate the roots of equation using Regula-Falsi method and Newton Raphson method. (L3)
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Seidal method. (L3)

UNIT - III (10 Hrs)

Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of interpolation. (L2)
- Derive interpolating polynomial using Newton's forward and backward formulae. (L3)
- Derive interpolating polynomial using Lagrange's formulae. (L3)
- Derive interpolating polynomial using Gauss forward and backward formulae. (L3)

UNIT - IV (12 Hrs)

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations- Euler's Method - Modified Euler's Method-Runge-Kutta Methods.

Learning Outcomes: At the end of this unit, students should be able to

- Solve initial value problems to ordinary differential equations using Taylor's method. (L3)
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods. (L3)

UNIT - V (12 Hrs)

Numerical Integration & Curve Fitting:

Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Fitting of straight line – second degree curve –Exponential curve –Power curve by the method of least squares.

Learning Outcomes: At the end of this unit, students should be able to

- Fit a best curve using method of least squares. (L3)
- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule. (L3)
- Solve integral equations using Trapezoidal rule. (L3)

TEXTBOOKS:

1. “Higher Engineering Mathematics”, B. S. Grewal, Khanna publishers.
2. “Advanced Engineering Mathematics”, Erwin Kreyszig, Wiley India
3. “Introductory Methods of Numerical Analysis”, S. S. Sastry, PHI publishers.

REFERENCE BOOKS:

1. “Higher Engineering Mathematics”, B. V. Ramana, Mc Graw Hill publishers.
2. “Advanced Engineering Mathematics”, Alan Jeffrey, Elsevier Publishers
3. “A Text Book of Engineering Mathematics Vol – I”, T.K.V. Iyengar, B. Krishna Gandhi, S. Chand & Company.

Course Code	FUNDAMENTALS OF ELECTRICAL CIRCUITS (Common to EEE & ECE)		L	T	P	C
21A020301			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Basic characteristics of R, L, C parameters, their Voltage and Current Relations and Various combinations of these parameters
- The Single-Phase AC circuits and concepts of real power, reactive phasor, complex power, phase angle and phase difference
- Series and parallel resonances, bandwidth, current locus diagrams
- Network theorems and their applications
- Network Topology and concepts like Tree, Cut-set, Tie-set, Loop, Co-Tree

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the equivalent impedance by using network reduction techniques and determine the current through, voltage across and power through any element

CO2: Determine the Dual of the network; develop the Cut Set and Tie-set Matrices for a given Circuit. Also understand various basic definitions and concepts

CO3: Determine the real power, reactive power, power factor of a given excitation.

CO4: Apply the network theorems suitably

CO5: Analyze the three-phase circuits with star-delta transformation

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT-I (12 Hours)

Introduction to Electrical & Magnetic Circuits: Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage – Current Relationship for Passive Elements. Kirchhoff's Laws – Network Reduction Techniques- Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation and Examples

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits, MMF Calculations.

Learning Outcomes: At the end of this unit, students should be able to

- Know about Kirchhoff's Laws in solving series, parallel, non-series-parallel configurations in DC networks (L2)

- Know about voltage source to current source and vice-versa transformation in their representation (L2)
- Understand Faraday's laws (L2)
- Distinguish analogy between electric and magnetic circuits (L2)
- Understand analysis of series and parallel magnetic circuits (L2)

<u>UNIT- II</u> (12 Hours)

Network Topology: Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic graph theory definitions which are required for solving electrical circuits (L2)
- Understand about loop current method (L2)
- Understand about nodal analysis methods (L2)
- Understand about principle of duality and dual networks (L2)
- Identify the solution methodology in solving electrical circuits based on the topology (L2)

<u>UNIT- III</u> (12 Hours)

Single Phase A.C Circuits: R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation- Resonance - Phasor diagrams - Concept of Power Factor- Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples.

Learning Outcomes: At the end of this unit, students should be able to

- Understand fundamental definitions of 1-ϕ AC circuits (L2)
- Distinguish between scalar, vector and phasor quantities (L2)
- Understand voltage, current and power relationships in 1-ϕ AC circuits with basic elements R, L, and C. (L2)
- Understand the basic definitions of complex immittances and complex power (L2)
- Solve 1-ϕ AC circuits with series and parallel combinations of electrical circuit elements R, L and C. (L2)

UNIT- IV (12 Hours)

Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millmann's, Tellegen's, and Compensation Theorems for D.C and Sinusoidal Excitations.

Learning Outcomes: At the end of this unit, students should be able to

- Know that electrical circuits are 'heart' of electrical engineering subjects and network theorems are main part of it. (L2)
- Distinguish between various theorems and inter-relationship between various theorems (L2)
- Know about applications of certain theorems to DC circuit analysis (L2)
- Know about applications of certain theorems to AC network analysis (L2)
- Know about applications of certain theorems to both DC and AC network analysis (L2)

UNIT- V (12 Hours)

Three Phase A.C. Circuits: Introduction - Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits - Loop Method - Star Delta Transformation Technique – for balanced and unbalanced circuits - Measurement of Active and reactive Power – Advantages of Three Phase System.

Learning Outcomes: At the end of this unit, students should be able to

- Know about advantages of 3-ϕ circuits over 1-ϕ circuits (L2)
- Distinguish between balanced and unbalanced circuits (L2)
- Know about phasor relationships of voltage, current, power in star and delta connected balanced and unbalanced loads(L2)
- Know about measurement of active, reactive powers in balanced circuits (L2)
- Understand about analysis of unbalanced circuits and power calculations (L2)

TEXTBOOKS:

1. "Fundamentals of Electric Circuits", Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. "Engineering circuit analysis", William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.

REFERENCE BOOKS:

1. "Circuit Theory Analysis & Synthesis", A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018.
2. "Network Analysis", M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.

3. “Electrical Engineering Fundamentals”, V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
4. “Electric Circuits- Schaum’s Series”, Mc Graw Hill, 5th Edition, 2010.
5. “Electrical Circuit Theory and Technology”, John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

Course Code	C-PROGRAMMING & DATA STRUCTURES (Common to all branches)		L	T	P	C
21A050302			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- Demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C using Arrays and Strings.
CO3: Modularize the problem and also solution.
CO4: Design applications in C using Functions, Pointers, and Structures.
CO5: Explore various operations on Stacks, Queues and Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Computer Fundamentals, Algorithm, Flowchart.

Introduction to C Language: Characteristics, Identifiers, Constants, Data types, Keywords, Basic input/output statements, Structure of a C program.

Operators and Expressions: Operators classification, Assignment Operator, Arithmetic Operators, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators with examples – Operator precedence and Associativity, Type casting.

Statements: Simple and Compound statements, Control Statements - Conditional/Decision statements, Loop Control Statements, Branch Control statements.

Learning Outcomes: At the end of this unit, students should be able to

- Solve complex problems using language independent notations (L3)
- Use C basic concepts to write simple C programs (L3)
- Test and execute the programs and correct syntax and logical errors (L4)
- Select the control structure for solving the problem (L4)
- Implement conditional branching, iterations (L2)

UNIT-II (12 Hrs)

Arrays: Declarations, Initialization and accessing elements, Single, Two and Multi-dimensional arrays.

Array Techniques: Array order reversal, finding the maximum and minimum number in a set, sorting the given array elements.

Strings: String I/O functions, String handling functions, Data conversion functions.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Use arrays to process multiple homogeneous data (L3)
- Solve mathematical problems using C Programming languages (L3)
- Apply string handling functions (L3)

UNIT-III (12 Hrs)

Functions: Types of functions, Library functions, User-defined functions, Function Categories, Nested functions, Recursion, Symbolic constants, Pre-processor Commands, Storage classes – auto, register, static, extern, Type qualifiers.

Input and output: Standard input and output, Non-formatted Input and Output statements, Formatted Input and Output statements.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand basic terminology of modular programming (L2)
- Apply modular approach for solving the problem (L3)
- Writing C programs using various storage classes to control variable access (L5)
- Apply input and output statements to process the data in various formats (L3)

UNIT-IV (12 Hrs)

Pointers: Pointers and addresses, Passing parameters to functions, Address Arithmetic operations, Void and Null pointers, Pointer and Arrays, Pointer and Strings, Array of Pointers, Pointer and Functions, Pointer-to-Pointer, Dynamic Memory Allocation. Uses of Pointers, Command line Arguments.

Structure and Union: Declaration and Initialization of a structure, Copy and comparisons, Array of structures, Structure with pointer, Nested structures, Type Definition, Enumeration, Union.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Structure the individual data elements to simplify the solutions (L6)
- Facilitate efficient memory utilization (L6)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT-V (14 Hrs)

Data Structures: Overview of data structures, **Stack:** Representation of a stack, Operations and Applications of a Stack – Evaluation of Arithmetic Expressions, Implementation of Recursion – **Queue:** Representation of a queue, Operations and Applications of a Queue – CPU Scheduling in Multi-programming Environment.

Linked List: Representations of linked lists, singly linked list, doubly linked list, Circular linked list and its operations.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the operations of a stack (L2)
- Develop various operations on Queues (L6)
- Analyze various operations on singly linked list (L4)
- Interpret operations of doubly linked lists (L2)
- Apply various operations on Circular linked lists (L6)

TEXTBOOKS:

1. "The Complete Reference C", Herbert Schildt, McGraw Hill Education, Fourth Edition
2. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
3. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition
2. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

Course Code	ENGINEERING DRAWING (Common to all branches)		L	T	P	C
21A030301			1	0	4	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.
- Instruct graphical representation of machine components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Construction of various conic curves, Cycloid curves
CO2: Construction of projections of Points, Lines applied in engineering
CO3: Construction of projections of Planes.
CO4: Construction of projection of solids development of surfaces regular Solids.
CO5: Representation of Ortho and Isometric views of solids.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO4	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO5	3	2	2	-	3	-	-	-	-	2	-	2	2	2

UNIT-I (12 Hrs)

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance - Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, Epi-cycloid and Hypocycloid - general method only.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of engineering drawing (L2)
- Know the conventions used in the engineering drawing (L1)
- Identify the curves obtained in different conic sections (L2)
- Draw different cycloidal curves. (L3)

UNIT– II (12 Hrs)

Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, true angle made by line.

Learning Outcomes: At the end of this unit, students should be able to

- Know how to draw the projections of points, lines (L1)
- Find the true length of the lines. (L2)

UNIT-III (18 Hrs)

Projection of planes: Projections of regular plane inclined to both the planes and also draw the projections of different planes in Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of planes. (L2)
- Draw the projection of plane inclined to one plane and both the planes. (L3)
- Understand the different commands used in Computerized drawing to draw different planes. (L2)

UNIT- IV (15 Hrs)

Projections of solids: Projections of regular solids inclined to one or both planes by rotational method.

Development of Solids: Development of lateral Surfaces of Right Regular Solids(without section)-Prism, Cylinder, Pyramid, Cone.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of solids. (L2)
- Draw the projection of solid inclined to one plane. (L3)
- Draw the projection of solids inclined to both the planes. (L3)

UNIT–V (18 Hrs)

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale-Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Conversion of Isometric Views to Orthographic Views. Drawing the Isometric views using Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the basics convectional representation of different projections (L1)
- Draw the Orthographic projection of simple solids. (L3)
- Draw the Isometric projection of simple solids. (L3)

TEXTBOOKS:

1. "Engineering Drawing", K. L. Narayana & P. Kannaiah, SciTech Publishers, Chennai, 3/e.
2. "Engineering Drawing + AutoCAD", K. Venugopal, V. Prabhu Raja, New Age Publishers.
3. "Engineering Drawing", N. D. Bhatt, Charotar Publishers, 53/e, 2016

REFERENCE BOOKS:

1. "Engineering Drawing", Dhanajay A Jolhe, Tata McGraw-Hill, Copy Right, 2009.
2. "Engineering Drawing", Basant Agarwal & C. M. Agarwal, Tata McGraw-Hill
3. "Engineering Drawing", Shah and Rana, Pearson Education, 2/e, 2009

Course Code	FUNDAMENTALS OF ELECTRICAL CIRCUITS LAB (Common to EEE & ECE)		L	T	P	C
21A020302			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To analyze the given network by applying mesh and nodal analysis
- Remember, understand and apply various theorems and verify practically.
- Understand and analyze active, reactive power measurements in three phase balanced circuits.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design and verify the various Kirchhoff's laws

CO2: Understand the electrical circuits by using mesh and nodal analysis

CO3: Remember, understand and apply various theorems and verify practically.

CO4: Understand and analyze active, reactive power measurements in three phase balanced circuits.

CO5: Determine the active, reactive power measurements in three-phase balanced and unbalanced circuits

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	2	2	2	3	-	-	-	-	1	3	2
CO2	2	1	3	2	2	2	2	-	-	-	-	1	3	2
CO3	2	1	3	2	2	2	1	-	-	-	-	1	3	2
CO4	2	1	3	2	2	2	1	-	-	-	-	1	3	2
CO5	2	1	3	2	2	2	2	-	-	-	-	1	3	2

List of Experiments:

1. Verification of Kirchhoff's laws
2. Verification of Mesh and Nodal analysis
3. Verification of Thevenin's and Norton's Theorems
4. Verification of Superposition Theorem for average values
5. Maximum Power Transfer Theorem for DC circuits
6. Verification of Reciprocity, Millmann's Theorems for DC circuits
7. Determination of Self, Mutual Inductances and Coefficient of Coupling
8. Measurement of Active Power for Star Connected Balanced Loads
9. Measurement of Reactive Power for Star Connected Balanced Loads
10. Measurement of Active Power for Delta Connected Balanced Loads
11. Measurement of Reactive Power for Delta Connected Balanced Loads

Note: Any ten experiments should be performed from the above list of experiments

TEXTBOOKS:

1. "Fundamentals of Electric Circuits", Charles K. Alexander and Matthew. N. O. Sadiku, McGraw Hill, 5th Edition, 2013
2. "Engineering circuit analysis", William Hayt and Jack E. Kemmerly, McGraw Hill Company, 7th Edition, 2006

Course Code	C-PROGRAMMING & DATA STRUCTURES LAB (Common to all branches)		L	T	P	C
21A050303			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of C Programming
- To make the student solve problems, implement algorithms using C language
- To design programs using arrays, strings, pointers and structures
- To design Stack and Queue operations
- To apply different operations o linked lists

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Demonstrate the basic concepts of C programming language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs using functions, arrays, structures and pointers.
CO4: Illustrate the concepts Stacks and Queues.
CO5: Design operations on Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

Week 1

a) Write a C program to swap the given two integer values without using temporary variable.
b) Write a C program to print the first ‘N’ Fibonacci sequence numbers.

Week 2

a) Write a C program to print reverse of a given integer value.
b) Write a C program to find the roots of a quadratic equation.

Week 3

Write a C program that use recursive functions.

i) GCD of given two values.
ii) Factorial of a given value.

Week 4

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program to perform the following:

i) Addition of Two matrices ii) Multiplication of Two matrices

Week 5

a) Write a C program that displays the position or index in the string S where the string T begins or -1 if S doesn't contain T.

b) Write a C program to read a set of strings and sort them in alphabetical order.

Week 6

a) Write a C program to count number of alphabets, digits and special symbols of a given line.

b) Write a C program to check whether a given string is palindrome or not.

Week 7

Write a C program to demonstrate the difference between call-by-value and call-by-address mechanisms.

Week 8

Write a program to perform the operations addition, subtraction, multiplication of complex numbers.

Week 9

Write a C program that implement stack operations using arrays.

Week 10

a) Write a C program that implement linear queue operations using arrays.

b) Write a C program that implement circular queue operations using arrays.

Week 11

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on doubly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following operations on circular linked list.
i) Creation ii) Insertion iii) Deletion iv) Traversal

TEXTBOOKS:

1. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
2. "Computer Science: A Structured Programming Approach Using C", B.A. Forouzon and R.F. Gilberg, CENGAGE Learning, Third Edition, 2016.
3. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition,
2. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.

Course Code	COMMUNICATIVE ENGLISH LAB		L	T	P	C
21A110201	(Common to all branches)		0	0	2	1
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with special emphasis on Listening and Speaking skills.
- To equip students with professional skills & soft skills, Develop communication skills in formal and informal situations
- To help students present themselves confidently during Group Discussions and Oral Presentations

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use creativity in listening to formal and informal conversations.
CO2: Analyze the concepts of active listening and barriers to listening.
CO3: Communicate effectively in everyday life using right oral expressions.
CO4: Acquire the confidence to present themselves effectively during academic and professional presentations.
CO5: Acquire basic knowledge of non-verbal communication and its importance.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	3	-	-	-	-	-

UNIT-I (6 Hrs)

Essentials of Listening: Purpose of Listening, Listening to Conversation (Formal and Informal), Active Listening- an Effective Listening Skill, Barriers to Listening, Listening to Announcements- (railway/ bus stations/ airport /sports announcement/commentaries etc.)

Learning Outcomes: At the end of this unit, students should be able to

- Know the difference between hearing and listening. (L2)
- Understand the purpose of active listening. (L2)
- Follow the announcements through focused listening. (L2)

UNIT-II (6 Hrs)

Listening Comprehension: Academic Listening (Listening to Lectures), Listening to Short Talks and Listening to Presentations, Note Taking Tips

Learning Outcomes: At the end of this unit, students should be able to

- Comprehend different academic lectures. (L3)
- Take notes while listening to short talks and lectures. (L3)
- Improve comprehension skills through listening to short talks and presentations. (L3)

UNIT-III (6 Hrs)

Communicating in everyday life: Asking for and giving information, Offering and responding to offers, Requesting and responding to requests, Congratulating people on their success, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving,

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate expressions to communicate in everyday life. (L3)
- Communicate effectively in different contexts of conversations. (L3)
- Participate in role plays and situational dialogues with an exposure to social and professional contexts. (L3)

UNIT- IV (6 Hrs)

Presentation Skills: Giving Short Talks, Preparing power point presentation, Greeting and Introducing in presentations, Presenting a paper, Participating in group discussions (dos & don'ts)

Learning Outcomes: At the end of this unit, students should be able to

- Prepare a power point presentation effectively. (L3)
- Present a paper in a seminar. (L3)
- Participate in Group Discussions efficiently. (L3)

UNIT-V (6 Hrs)

Non-verbal Communication: Personal Appearance, Gestures, Postures, Facial Expression, Eye Contact, Body Language (Kinesics), Silence, Tips for Improving Non-Verbal Communication

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of body language in communication (L2)
- Improve non-verbal communication skills (L3)
- Understand how body language and non-verbal communication affects the personality of an individual in a social and professional set-up. (L2)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt

2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://learnenglish.britishcouncil.org/skills/listening
2. https://agendaweb.org/listening/comprehension-exercises.html
3. https://www.123listening.com/
4. https://www.linguahouse.com/learning-english/skill-4-learners/listening
5. https://www.talkenglish.com/listening/listen.aspx
6. https://ed.ted.co

Course Code	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to CE, EEE & ECE)		L	T	P	C
21A110103			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve the differential equations related to various engineering fields.
CO2: Apply a range of techniques to find solutions of standard PDEs.
CO3: Identify solution methods for partial differential equations that model physical Processes.
CO4: Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO5: Estimate the work done against a field, circulation and flux using vector calculus.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	3	-	-	-	-	-	-	-	1	-	-
CO5	2	3	2	2	-	-	-	-	-	-	-	1	-	-

UNIT – I (13 Hrs)

Linear differential equations of higher order (Constant Coefficients): Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian method of variation of parameters. Simultaneous linear equations, Applications toL-C-R Circuit problems and Mass spring system.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the essential characteristics of linear differential equations with constant coefficients (L3)
- Solve the linear differential equations with constant coefficients by appropriate method (L3)
- Classify and interpret the solutions of linear differential equations (L3)
- Formulate and solve the higher order differential equation by analysing physical situations (L3)

UNIT– II (11 Hrs)

Partial Differential Equations: Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method.

Learning Outcomes: At the end of this unit, students should be able to

- Apply a range of techniques to find solutions of standard PDEs (L3)
- Outline the basic properties of standard PDEs (L2)

UNIT – III (12 Hrs)

Applications of Partial Differential Equations: Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation and Laplace's Equation.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the PDE (L3)
- Learn the applications of PDEs (L2)

UNIT– IV (13 Hrs)

Vector differentiation: Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Learning Outcomes: At the end of this unit, students should be able to

- Apply del to Scalar and vector point functions (L3)
- Illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

UNIT – V (14 Hrs)

Vector integration: Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stroke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Learning Outcomes: At the end of this unit, students should be able to

- Find the work done in moving a particle along the path over a force field (L4)
- Evaluate the rates of fluid flow along and across curves (L4)
- Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

TEXTBOOKS:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.
2. "Higher Engineering Mathematics", B.S. Grewal, Khanna publishers, 44/e, 2017.

REFERENCE BOOKS:

1. “Engineering Mathematics”, T. K. V Iyengar, Dr. B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications
2. “Advanced Engineering Mathematics”, Michael Greenberg, Pearson, 2/e, 2018
3. “Calculus”, George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
4. “Advanced Engineering Mathematics”, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.
5. “Advanced Modern Engineering Mathematics”, Glyn James, Pearson publishers, 4/e, 2011.
6. “Advanced Engineering Mathematics”, Michael Greenberg, Pearson edn, 9th edition
7. “Advanced engineering mathematics with MATLAB”, Dean G. Duffy, CRC Press
8. “Advanced Engineering Mathematics”, Peter O’Neil, Cengage Learning.
9. “Engineering Mathematics Volumes-I &II”, R.L. Garg Nishu Gupta, Pearson Education
10. “Higher Engineering Mathematics”, B. V. Ramana, McGraw Hill Education.
11. “Higher Engineering Mathematics”, H. K Das, Er. Rajnish Verma, S. Chand.
12. “Advanced Engineering Mathematics”, N. Bali, M. Goyal, C. Watkins, Infinity Science Press.

Course Code	APPLIED PHYSICS (Common to EEE, ECE & CSE)		L	T	P	C
21A110104			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To identify the importance of the physical optics i.e., interference, diffraction and polarization related to its engineering applications
- To understand the mechanisms of lasers and propagation of light through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging microdevices.
- To present the basic concepts needed to understand the crystal structure of materials, X- ray diffraction and the importance of nano materials.
- Evolution of band theory to distinguish materials and explain the properties of semiconductors and superconductors.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the differences between interference, diffraction & polarization with applications.

CO2: Identify the importance of lasers and fiber optics in different engineering fields

CO3: Understand the response of dielectric & magnetic materials to the applied electric & magnetic fields

CO4: Explain the important properties of crystals & structure determination using X-ray diffraction along with the nano materials.

CO5: Elaborate the physical properties of semiconductors and superconductors

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-

UNIT-I (13 Hrs)

Wave Optics Interference- Principle of superposition – Interference of light – Conditions for sustained interference - Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit – Grating spectrum.

Polarization- Introduction – Types of polarization – Polarization by double refraction- Nicol's

Prism - Half wave and Quarter wave plates with applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the need of coherent sources and the conditions for sustained interference (L2)
- Identify engineering applications of interference (L3)
- Analyze the differences between interference and diffraction with applications (L4)
- Illustrate the concept of polarization of light and its applications (L2)
- Classify ordinary polarized light and extraordinary polarized light (L2)

UNIT-II (12 Hrs)

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Transmission of Signals in Step index and graded index fiber – Propagation Losses (qualitative) – Block diagram of Fiber Optics Communication System- Applications of Fibers in medical field.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

UNIT-III (12 Hrs)

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius- Mosotti relation in dielectrics (L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)

- Explain the applications of dielectric and magnetic materials (L2)

UNIT-IV (12 Hrs)

Crystallography: Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Laue method - Powder method.

Nano materials – Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nano materials.

Learning Outcomes: At the end of this unit, students should be able to

- Classify various crystal systems (L2)
- Identify different planes in the crystal structure (L3)
- Analyze the crystalline structure by Bragg's law to measure the crystallinity of a solid by powder method (L4)
- Identify the nano size dependent properties of nanomaterials (L2)
- Illustrate the methods for the synthesis and characterization of nanomaterials (L2)
- Apply the basic properties of nanomaterials in various Engineering branches (L3)

UNIT- V (12 Hrs)

Semiconductors and Superconductors

Semiconductors- Origin of energy bands - Classification of solids into conductors, semiconductors and insulators -Intrinsic and extrinsic semiconductors (Qualitative treatment)– Density of carriers and Fermi levels in intrinsic & extrinsic semiconductors - Drift& diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) – High T_c superconductors – Applications of superconductors.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)
- Explain how electrical resistivity of solids changes with temperature (L2)
- Classify superconductors based on Meissner's effect (L2)
- Explain Meissner's effect, BCS theory & Josephson effect in superconductors (L2)

TEXTBOOKS:

1. "Engineering Physics", Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, S. Chand and Company
2. "Engineering Physics", B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. "Engineering Physics", K. Thyagarajan, McGraw Hill Publishers

REFERENCE BOOKS:

1. "Engineering Physics", Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. "Engineering Physics", Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
3. "Semiconductor physics and devices - Basic principles", Donald A, Neamen, McGraw Hill
4. "Engineering physics", P.K. Palanisamy, SCITECH Publications
5. "Applied Physics", S. Mani Naidu, Pearson Publications
6. "Lasers and Non-Linear Optics", B.B Laud, New Age International Publishers.

Course Code	APPLIED CHEMISTRY (Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110105			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize Applied chemistry and applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods and applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the salient features of different theories along with their applications.
CO2: Discuss about the model engineering materials.
CO3: Apply the knowledge of various electrodes for the development of new batteries.
CO4: Identify the different polymers and their uses in various fields of engineering.
CO5: Analyze the knowledge of different analytical techniques used in engineering and also development of new techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	-

UNIT-I (14 Hrs)

Structure and Bonding Models: Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, Molecular orbital theory –bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, π-molecular orbitals of butadiene and benzene, calculation of bond order. Crystal field theory–salient features–splitting in octahedral and tetrahedral geometry.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Discuss the basic concept of molecular orbital theory (L3)
- Explain the calculation of bond order of O_2 and CO molecules (L2)
- Discuss the salient features of Crystal field theory (L3)

UNIT-II (10 Hrs)

Modern Engineering Materials: Band theory of solids- band diagrams for conductors, Insulators, Semiconductors, Effect of doping on band structures.

Super conductors and Super capacitors: Introduction, Definition, Classification, Applications.

Nano chemistry: Introduction, classification of nano materials, properties and applications of Fullerenes, carbon nanotubes and Graphene nanoparticles.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nanotubes and Graphenes nanoparticles (L2).

UNIT-III (13 Hrs)

Electro Chemistry and Applications: Electrodes and their concepts, Types of Reference electrodes-their applications. Electrochemical cell, Nernst equation, Numerical problems on emf.

Primary cells – Zinc-air battery, Secondary cells – Lead-acid and Lithium-ion batteries-working of the batteries including cell reactions; Fuel cells- hydrogen-oxygen, methanol- oxygen fuel cells – working of the cells.

Potentiometry- principle, potentiometric titrations (redox titrations), Conductometry- conductometric titrations (acid-base titrations).

Electrochemical sensors– potentiometric sensors principle with examples, ampere metric sensors principle with examples and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)

UNIT-IV (13 Hrs)

Polymer Chemistry: Introduction to polymers, functionality of monomers and their significance, Tacticity of polymers, Types of polymerization- chain growth, step growth and copolymerization with specific examples and mechanisms of polymer formation.

Plastomers-Thermoplastics and Thermo setting plastics, Preparation, properties and applications of– PVC, Teflon, Bakelite, Nylons.

Elastomers – Buna-S, Buna-N– preparation, properties and applications of Buna-S, Buna-N.

Conducting polymers, examples, classification, polyacetylene, polyaniline - mechanism of conduction and applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylons (L2)
- Describe the mechanism of conduction in conducting polymers (L2)

- Discuss Buna-S and Buna-N and their applications (L2)

<u>UNIT-V</u> (10 Hrs)

Instrumental Methods and Applications: Introduction, Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law- Principle, instrumentation and applications of UV-Visible**,** IR-Spectroscopy's and pH-metry, Solid-Liquid Chromatography–TLC, retention factor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles and applications of different analytical instruments (L2)

<u>TEXTBOOKS:</u>

1. "Engineering Chemistry", Jain and Jain, Dhanpat Rai publications, 17/e, 2018
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014
3. "Principles of Instrumental Analysis", Skoog, FJ Holler and SR Crouch, 7/e, 2018
4. "Applied Chemistry", Guesser, Springer's Publications, 2001
5. "Atkins' Physical Chemistry", Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 10/e, 2010

<u>REFERENCE BOOKS:</u>

1. "Concise Inorganic Chemistry", J. D. Lee, Oxford University Press, 5/e, 2008
2. "Engineering Chemistry", G. V. Subba Reddy, K. N. Jayaveera and Ramachandraiah, McGraw Hill, 2020.

Course Code	ENGLISH FOR PROFESSIONALS		L	T	P	C
21A110202	(Common to all branches)		2	0	0	2
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To improve Reading and Writing proficiency of students in English with an emphasis on Vocabulary development.
- To provide knowledge of grammatical structures and encourage their appropriate use in writing.
- To improve students' comprehension skills required for academic and professional needs.
- To equip students with writing skills required for professional correspondence in different contexts.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate word knowledge and its usage in appropriate contexts.
CO2: Recognize and incorporate basic grammar mechanics and sentence variety in writing.
CO3: Improve comprehension skills through intensive and extensive reading practice.
CO4: Learn and apply various writing formats for effective communication.
CO5: Improve writing skills needed for professional correspondence in various contexts.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

UNIT-I (10 Hrs)

Vocabulary Building: Introduction to affixes and base words, Prefixes and suffixes, Basic comparing and contrasting, Idioms and Phrases, One word substitutes, Words often confused, Synonyms and Antonyms used in the everyday contexts, Using prior knowledge to determine the correct word for the context, Discovering the correct word in the sentence by looking at the surrounding words, Vocabulary in social interactions.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize word parts: affixes, prefixes, suffixes and base words. (L2)
- Use words appropriately in a context. (L3)
- Guess the meanings of the words by using the contextual clues. (L2)
- Use synonyms, antonyms, phrases and idioms in writing. (L2)

UNIT-II (10 Hrs)

Essentials of Sentence Formation: Basic Sentence Structure, word order, Subject-Verb Concord, Using Tenses, Punctuation Marks, Correction of Common Errors

Learning Outcomes: At the end of this unit, students should be able to

- Frame a sentence without any grammatical errors. (L3)
- Use appropriate punctuation marks. (L3)
- Identify common errors in a sentence. (L2)

UNIT-III (10 Hrs)

Reading Comprehension: Understanding short real-world notices, messages, factual material - Scanning, skimming - Inferring meaning - Critical reading - Reading and information transfer

Learning Outcomes: At the end of this unit, students should be able to

- Use skimming and scanning strategies while reading. (L3)
- Infer meaning from the given text. (L3)
- Distinguish between the main idea and supporting ideas. (L3)
- Critically analyse the given text. (L4)

UNIT-IV (10 Hrs)

Writing Skills: Rules for good writing and composition; Paragraph Writing: Structure of a paragraph, Types of paragraphs, Usage of Cohesive Devices; Essay writing: Structure of an Essay, Types of Essays; Letter Writing (Formal and informal): Format and Structure; and Email writing

Learning Outcomes: At the end of this unit, students should be able to

- Learn to organize thoughts into meaningful paragraphs. (L2)
- Use cohesive devices in making the piece of writing more coherent. (L3)
- Compose essays on different topics in a more organised structure. (L3)
- Draft letter and emails in a definite format. (L3)

UNIT-V (10 Hrs)

Professional Correspondence: Internal Correspondences – Memorandum, Note Taking, Minutes of Meetings; External Correspondences - Business Letters - Cover Letters - Sale Letters - Inquiry Letters - Complaint Letters - Emails & Netiquette

Learning Outcomes: At the end of this unit, students should be able to

- Draft official e-mails and letters for different professional purposes. (L3)
- Write proficiently memos and minutes of meeting. (L3)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://digital.library.upenn.edu/women/sultana/dream/dream.html
2. https://owl.purdue.edu/
3. https://www.thesaurus.com/
4. https://www.readwritethink.org/classroom-resources/student-interactives
5. https://www.fluentu.com/blog/english/english-writing-websites/

Course Code	ELECTRONIC DEVICES AND CIRCUITS (Common to EEE & ECE)		L	T	P	C
21A040301			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To introduce different types of semiconductor devices, viz., diodes and special diodes.
- To explain application of diodes as rectifiers, regulators, and voltage doubler.
- To describe operation and characteristics of Bipolar Junction Transistor& Field Effect transistors.
- To analyse the various biasing circuits using BJTs & FETs
- To analyse the BJT amplifiers using h parameter model.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Describe basic operation and characteristics of various PN junction diodes.

CO2: Analyze diode circuits for different applications such as rectifiers with and without filters, regulators, and voltage doubler.

CO3: Explain principle, operation, and applications of BJT, FET & MOSFET.

CO4: Design various biasing circuits for BJT, FET & MOSFET.

CO5: Analyze BJT amplifiers using h parameter model.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	2

UNIT-I (12 Hrs)

PN Junction Diode & Special Purpose Devices: Open circuited PN junction, operation, Current components in a PN diode, Diode Equation and its mathematical derivation, Volt-Ampere Characteristics, Energy band diagram of PN diode, Temperature dependence of Volt-Ampere Characteristics, Diode resistance (Static and Dynamic resistance), Diode capacitances (Transition and Diffusion capacitance).

V-I Characteristics of Zener diode, Avalanche breakdown and Zener breakdown. Principle of Operation, and Characteristics of Tunnel Diode, Varactor Diode, Schottky Barrier Diode, Silicon Control Rectifier & Uni-Junction Transistor (UJT), Semiconductor photo devices - LDR, LED, Photo diodes & Photo transistors.

Learning Outcomes: At the end of this unit, students should be able to

- Study the characteristics and operation of p-n junction diode and special diodes. (L1)
- Explain the energy band diagram & effect of temperature on the characteristics of diode. (L2)
- Derive the expression for transition capacitance and diffusion capacitance. (L2)

UNIT-II (10 Hrs)

Diode Applications: Diode as switch, Rectifier – Half wave and Full wave rectifier, Bridge rectifier, Ripple factor, PIV, Filters – Inductor and Capacitor Filter, L-section filter, pi-Filter, Zener as voltage regulator, Voltage doubler, Problem solving related to diode applications.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the circuit operation involving p-n junction and Zener diodes. (L2)
- Analyze the performance of rectifiers with and without filters. (L4)
- Design half wave and full wave rectifier circuits and voltage regulator. (L5)
- Compare the various rectifier circuits in terms of their parameter metrics. (L5)

UNIT-III (12 Hrs)

Transistor And FET Characteristics: Transistor construction, BJT Operation, BJT Symbol, Transistor as an Amplifier, Common Emitter, Common Base and Common Collector Configurations, Determination of h-Parameters from Transistor Characteristics, The Junction Field Effect Transistor (Construction, Principle of Operation, Symbol) - Pinch-Off Voltage – Volt-Ampere Characteristics, FET as Voltage Variable Resistor, Comparison between BJT and FET, MOSFET- Basic Concepts, Construction, modes(depletion & enhancement), symbol, principle of operation, characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Explain principle, operation, application of Bipolar Junction Transistor, FET and MOSFET. (L2)
- Describe input, output Characteristics of Bipolar Junction Transistor, FET and MOSFET. (L2)
- Analyze the different configurations (CB, CC, CE). (L4)

UNIT-IV (12 Hrs)

Biasing And Stabilization: Operating Point, DC and AC Load Lines, Importance of Biasing, Fixed Bias, Collector to Base Bias, Self-Bias, Bias Stability, Stabilization against Variations in I_{CO}, V_{BE} and β, Bias Compensation Using Diodes and Transistors, Thermal Runaway, Condition for Thermal Stability in CE configuration, Biasing of FET & MOSFET – self-bias, voltage divider bias, Illustrative problems.

Learning Outcomes: At the end of this unit, students should be able to

- Derive the expression for stability factor of various biasing circuits. (L3)
- Explain Thermal Stability and its condition. (L2)
- Design different biasing circuits of BJT,FET and MOSFET.(L5)

UNIT-V (14 Hrs)

Small Signal Analysis of BJT Amplifiers: BJT modelling using h-parameters, Analysis of CE, CB and CC configurations using h-Parameters, Comparison of CB, CE and CC configurations, Simplified Hybrid Model, Analysis of CE, CB and CC configurations using simplified Hybrid Model.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse different configurations of BJT using h parameter model. (L4)
- Compare CB, CE and CC configurations. (L4)

TEXTBOOKS:

1. "Electronic Devices and Circuits", J.Millman and Christos. C. Halkias, Satyabrata, TMH Third edition, 2012.
2. "Electronic Devices and Circuits", K. Lalkishore, BSP, 2nd edition, 2005

REFERENCE BOOKS:

1. "Electronic Devices and Circuits," R.L. Boylestad and Louis Nashelsky, 9th Edition, Pearson, 2006.
2. "Electronic Devices and Circuits", B.P.Singh and Rekha Singh, PEARSON, 2nd Edition, 2013.
3. "Electronic Devices and Circuits", David A. Bell, Oxford University press, 5th Edition, 2008.
4. "Electronic Devices and Circuits", N.Salivahanan and N. Suresh Kumar, TMH ,3rd Edition, 2012.

Course Code	APPLIED PHYSICS LAB		L	T	P	C
21A110108A	(Common to EEE, ECE & CSE)		0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- Understands the concepts of interference, diffraction, and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity in semiconductors
- Will recognize the applications of laser in finding the wavelength in diffraction studies

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Operate optical instruments like microscope and spectrometer.
CO2: Determine thickness of a hair/paper with the concept of interference.
CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.
CO4: Evaluate the acceptance angle of an optical fiber and numerical aperture.
CO5: Determine the resistivity of the given semiconductor using four probe method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO2	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO3	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO4	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO5	3	2	-	-	-	-	-	-	1	1	-	-	-	-

LIST OF EXPERIMENTS

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of wavelength of LASER light using diffraction grating.
5. Determination of numerical aperture and acceptance angle of a given optical fiber.
6. Magnetic field along the axis of a circular coil carrying current–Stewart Gee's method.
7. Determination of the resistivity of semiconductor by Four probe method.
8. Determination of particle size using LASER.
9. Study the variation of B versus H by magnetizing the magnetic material. (B-H curve)
10. Determination of Dispersive power of prism.

REFERENCE BOOKS:

1. "A Textbook of Practical Physics", S. Balasubramanian, M.N. Srinivasan, S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Code	**APPLIED CHEMISTRY LAB**		**L**	**T**	**P**	**C**
21A110108B	(Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of Chemistry
- To verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Distinguish different types of titrations in the volumetric analysis
CO2: Determine the cell constant and conductance of solutions
CO3: Measure the strength of an acid present in secondary batteries
CO4: Analyze the effect of absorbance of given sample solution on concentration by using colorimetry.
CO5: Prepare advanced polymer Bakelite materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-		-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Preparation of Standard Oxalic acid solution
2. Determination of Strength of an acid in Lead- Acid battery
3. Estimation of Ferrous Iron by Dichrometry
4. Potentiometry - Determination of redox potentials and emfs
5. Conductometry - Determination of cell constant and conductance of solutions.
6. Conductometric titration of a) strong acid vs strong base b) weak acid vs strong base.
7. p^H-metric titration of a) strong acid vs strong base b) weak acid vs strong base.
8. Verification of the Beer-Lambert's Law and determination of strength of the given unknown solution.
9. Determination of the Retention factor of the sample by Thin Layer Chromatography (TLC).
10. Measurement of 10Dq by spectrophotometric method.
11. Preparation of Bakelite and measurement of its mechanical properties (strength)
12. Preparation of nanomaterials.

TEXTBOOKS:

1. "A Text Book on Experiments and Calculations in Engineering Chemistry", S. Chand Publications, 9/e, 2003.
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014.
3. "Experiments in Applied Chemistry", Dr. Sunita Rattan, S. K. Kataria & Sons Publishers of Engineering, 2/e, 2004.

REFERENCE BOOKS:

1. "Vogel's Text Book of Quantitative Chemical Analysis", Mendham J et.al, Pearson Education, 6/e, 2012.

Course Code	ENGINEERING & IT WORKSHOP LAB		L	T	P	C
21A050301	(Common to all branches)		0	0	3	1.5
Pre-requisite	NIL	Semester	II			

PART-A (ENGINEERING WORKSHOP)

COURSE OBJECTIVES:

- To familiarize the students with wood working, sheet metal operations, fitting and electrical house, Wiring and foundry skills.
- To provide technical training to the students on Word, Excel and Presentation.
- To make the students know about the internal parts of a computer.
- To learn how to use Internet facility for Browsing and Searching.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply wood working skills and build different parts with metal sheets in real world applications.

CO2: Apply fitting operations in various applications and Preparation of moulds and castings.

CO3: Apply different types of basic electric circuit connections.

CO4: Prepare documentation, spread sheets for calculations and slides for Presentation.

CO5: Identify Computer peripherals and its functions, Internet browsing to obtain the required information

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	1	-
CO2	3	2	2	-	-	2	-	-	-	-	-	2	1	-
CO3	3	2	-	-	-	2	-	-	-	-	-	2	1	2
CO4	3	-	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

LIST OF TOPICS:

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint b) Dovetail joint or Bridle joint

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Square fit.

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections
a) Parallel and series b) Two-way switch c) Godown lighting

Foundry:

a) Preparation of mould cavity using single piece pattern.
b) Preparation of mould cavity using split piece pattern

PART-B (IT WORKSHOP)

LIST OF TOPICS:

Task 1:

MS-Word: Students should be able to create documents using the word processor tool. Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit report.

Task 2:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 3:

Presentations: creating, opening, saving the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, running the slide show.

Task 4: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 5:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.

REFERENCE BOOKS:

1. “Workshop Practice Manual”, K. Venkata Reddy, BS Publications.
2. “Engineering work shop practice for JNTU”, V. Ramesh babu, VRB Publishers Pvt. Ltd., 2009.
3. “Work shop manual”, P. Kannaiah, K. L. Narayana, SCITECH Publishers.
4. “Engineering practices lab manual”, Jeyapoovan, Saravanapandian, Vikas Publishing House, 4/E
5. “Dictionary of mechanical engineering”, GHF Nayler, Jaico Publishing House.
6. “Introduction to Computers”, Peter Norton, McGraw Hill
7. “MOS study guide for word, Excel, Power point & Outlook Exams”, Joan Lambert, Joyce Cox.
8. “Introduction to Information Technology”, ITL Education Solutions limited, Pearson Education.
9. “Networking your computers and devices”, Rusen, Prentice Hall of India
10. “Bigelow’s Trouble shooting, Maintaining & Repairing PCs”, Bigelow, Tata McGraw Hill Edition

Course Code	ELECTRONIC DEVICES & CIRCUITS LAB		L	T	P	C
21A040302	(Common to EEE & ECE)		0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To verify the theoretical concepts practically from all the experiments.
- To analyze the characteristics of diodes, UJT, BJT, FET, SCR.
- To design voltage divider biasing of BJT and JFET.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the parameters of Diodes and Transistors from the characteristics.
CO2: Demonstrate the rectifier and voltage regulator circuits using diodes.
CO3: Analyze the Characteristics of UJT and SCR
CO4: Design biasing circuit of BJT and FET.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	3	2	-	2	2	2
CO2	3	3	-	-	-	-	-	-	3	2	-	3	3	2
CO3	3	3	2	2	-	-	-	-	3	2	-	3	3	2
CO4	3	3	3	2	-	-	-	-	3	2	-	3	2	2

LIST OF EXPERIMENTS:

1. P-N Junction Diode Characteristics
   Part A: Germanium Diode (Forward bias & Reverse bias)
   Part B: Silicon Diode (Forward bias only)
2. Zener Diode Characteristics
   Part A: V-I Characteristics
   Part B: Zener Diode act as a Voltage Regulator
3. Rectifiers (without and with c-filter)
   Part A: Half-wave Rectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics (CE Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics.
5. BJT Characteristics (CB Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics

6. FET Characteristics (CS Configuration)
    Part A: Drain (Output) Characteristics
    Part B: Transfer Characteristics
7. SCR Characteristics
8. UJT Characteristics
9. Transistor Biasing
10. FET Biasing.

Tools / Equipment Required:
Licensed simulation software /DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs and all the required active devices.

Note: The students are required to design the circuit and they have to perform the analysis through simulator using Pspice/Equivalent Licensed simulation software tool. Further they are required to verify the result using necessary hardware in the hardware laboratory.

Course Code	ENVIRONMENTAL SCIENCE		L	T	P	C
21A000001	(Common to CE, ME, EEE, ECE, CSE, CSE-IOT)		**2**	**0**	**0**	**0**
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo- chemical cycles and ecological pyramids.

CO3: Understand various causes of pollution and solid waste management and related preventive measures.

CO4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5: Casus of population explosion, value education and welfare programmes.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO2	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO3	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO5	-	-	-	-	-	1	2	1	-	-	-	1	-	-

UNIT – I (10 Hrs)

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance, Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associatedproblems–Forestresources–Useandover–exploitation,deforestation,casestudies - Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of public awareness (L1)
- Know about the various resources (L1)

UNIT–II (10 Hrs)

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes: At the end of this unit, students should be able to

- Know about various echo systems and their characteristics (L1)
- Know about the biodiversity and its conservation (L1)

UNIT – III (10 Hrs)

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the various sources of pollution. (L1)
- Know about the various sources of solid waste and preventive measures. (L1)

- Know about the different types of disasters and their managerial measures. (L1)

UNIT- IV (10 Hrs)

Social Issues and The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, water shed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the social issues related to environment and their protection acts. (L1)
- Know about the various sources of conservation of natural resources. (L1)
- Know about the wild life protection and forest conservation acts. (L1)

UNIT – V (10 Hrs)

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the population explosion and family welfare programmes. (L1)
- Identify the natural assets and related case studies. (L1)

TEXTBOOKS:

1. “Text book of Environmental Studies for Undergraduate Courses”, Erach Bharucha for University Grants Commission, Universities Press.
2. “Environmental Studies”, Palani swamy, Pearson education
3. “Environmental Studies”, S. Azeem Unnisa, Academic Publishing Company
4. “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, K. Raghavan Nambiar, SCITECH Publications (India), Pvt. Ltd.

REFERENCE BOOKS:

1. "Textbook of Environmental Science", Deeksha Dave and E. Sai Baba Reddy, Cengage Publications.
2. "Text book of Environmental Sciences and Technology", M. Anji Reddy, BS Publication.
3. "Comprehensive Environmental studies", J. P. Sharma, Laxmi publications.
4. "Environmental Sciences and Engineering", J. Glynn Henry and Gary W. Heinke, Prentice Hall of India Private limited
5. "A Text Book of Environmental Studies", G. R. Chatwal, Himalaya Publishing House
6. "Introduction to Environmental Engineering and Science", Gilbert M. Masters and Wendell P. Ela, Prentice Hall of India Private limited.

Course Code	COMPLEX VARIABLES & TRANSFORMS		L	T	P	C
21A110112	(Common to EEE & ECE)		3	0	0	3
Pre-requisite	Calculus and Special Functions, Differential Equations &Vector Calculus	Semester	III			

COURSE OBJECTIVES:

- This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables.
- To equip the students to solve various application problems in engineering through evaluation of continuous/discrete transforms.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand functions of Complex variable and its properties, and find derivatives of complex functions, analyticity of complex functions.

CO2: Apply Cauchy's integral theorem and Cauchy's integral formula, integration of complex functions using Residue theorem.

CO3: Analyze the concept Laplace and Inverse Laplace Transforms to solve Differential equations.

CO4: Determine the process of finding Fourier series expression of the given function, Fourier coefficients (Euler's) and expansion of Half range series.

CO5: Identify the applications of Fourier integrals, properties of Fourier Transforms. Analyze the concept of Z transforms and its properties.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	-
CO4	3	2	3	3	-	-	-	-	-	-	-	2	3	-
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	-

UNIT – I (12 Hrs)

Complex Variable – Differentiation: Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method - Conformal mappings-standard and special transformations (sin z, e^z, cos z, z^2) Mobius transformations (bilinear) and their properties.

Learning outcomes: At the end of this unit, students should be able to

- Understand functions of Complex variable and its properties. (L2)
- Find derivatives of complex functions. (L3)
- Understand the analyticity of complex functions. (L2)

- Understand the conformal mappings of complex functions (L2)

UNIT- II (12 Hrs)

Complex Variable – Integration: Line Integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof); power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

Learning outcomes: At the end of this unit, students should be able to

- Understand the integration of complex functions. (L2)
- Apply Cauchy's integral theorem and Cauchy's integral formula. (L3)
- Understand singularities of complex functions. (L2)
- Evaluate improper integrals of complex functions using Residue theorem. (L4)

UNIT – III (12 Hrs)

Laplace Transforms: Definition-Laplace transform –Inverse Laplace Transform - standard functions - existence of Laplace Transform -shifting theorem's- Transforms of derivatives and integrals - Laplace transform of periodic function (without proof) - Unit step function - Dirac's delta function. –Convolution theorem – Differentiation and Integration of Transform- Solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Laplace transforms and Inverse Laplace transforms of Elementary functions. (L2)
- Understand Laplace transforms of special functions (Unit step function, Unit Impulse & Periodic). (L2)
- Apply Laplace transforms to solve Differential Equations (L4)

UNIT – IV (11 Hrs)

Fourier Series: Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions-typical wave forms -Parseval's formula- Complex form of Fourier series.

Learning outcomes: At the end of this unit, students should be able to

- Understand finding Fourier series expression of the given function. (L2)
- Determine Fourier coefficients (Euler's) and identify existence of Fourier series of the given function. (L3)
- Expand the given function in Fourier series given in Half range interval. (L2)
- Apply Fourier series to establish Identities among Euler coefficients. (L3)

UNIT – V (10 Hrs)

Fourier Transforms & Z Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem.

Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by Z-transforms.

Learning outcomes: At the end of this unit, students should be able to

- Find Fourier Sine and cosine integrals. (L3)
- Understand Fourier and Z transforms. (L2)
- Apply properties of Fourier and Z transforms (L3)
- Apply Z transforms to solve difference equations. (L3)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna publishers.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India

REFERENCE BOOKS:

1. "Higher Engineering Mathematics", B. V. Ramana, Mc Graw Hill publishers.
2. "Advanced Engineering Mathematics", Alan Jeffrey, Elsevier.
3. "An Introduction to Ordinary Differential Equations", E. A. Coddington, Prentice Hall India, 1995.
4. "A text book of Engineering Mathematics", N.P. Bali and Manish Goyal, Laxmi Publications, 2008.

Course Code	SIGNALS AND SYSTEMS		L	T	P	C
21A040401			3	0	0	3
Pre-requisite	Calculus and Special Functions, Mathematical Methods	Semester	III			

COURSE OBJECTIVES:

- To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domains.
- To present Fourier tools through the analogy between vectors and signals
- To describe the concepts of sampling and reconstruction of signals
- To describe the characteristics of linear systems in time and frequency domains.
- To understand Laplace and Z-transforms as mathematical tool to analyze continuous and discrete-time signals and systems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply Fourier series to analyze periodic signals and their spectra.
CO2: Analyze continuous time signals using Fourier transform and illustrate signal sampling and its reconstruction
CO3: Analyze discrete time signals using discrete time Fourier transform
CO4: Examine signal transmission through linear systems
CO5: Apply Laplace and Z- transform to analyze continuous and discrete time systems

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (11 Hrs)

Signals & Systems: Basic definitions and classification of Signals and Systems (Continuous time and discrete time), operations on signals, Concepts of Convolution and Correlation of signals, Analogy between vectors and signals-Orthogonality, mean square error, Fourier series: Trigonometric & Exponential, Properties of Fourier series, concept of discrete spectrum, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different types of signals and systems. (L2)
- State principles of vector spaces and concept of Orthogonality (L2)

- Describe continuous time signal and discrete time signal. (L2)
- Analyse the periodic signals by applying Fourier series. (L3)

UNIT – II (12 Hrs)

Continuous Time Fourier Transform: Definition, Computation and properties of Fourier transform for different types of signals and systems, Inverse Fourier transform. Statement and proof of sampling theorem of low pass signals, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Identify system properties based on impulse response and Fourier analysis. (L1)
- Analyze the spectral characteristics of signals. (L4)
- Illustrate signal sampling and its reconstruction. (L3)
- Apply Fourier transform to solve problems. (L3)

UNIT – III (12 Hrs)

Discrete Time Fourier Transform: Definition, Computation and properties of Discrete Time Fourier transform for different types of signals and systems, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the properties of the discrete-time Fourier transform. (L2)
- Analyse the spectral characteristics of signals using Fourier transform. (L4)
- Evaluate the Fourier transform of Discrete-time signals. (L4)

UNIT – IV (11 Hrs)

Signal Transmission Through Linear Systems: Linear system, impulse response, Response of a linear system for different input signals, linear time-invariant (LTI) system, linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between bandwidth and rise time, Energy and Power spectral densities, Illustrative Problems

Learning Outcomes: At the end of this unit, students should be able to

- Understand the impulse response, transfer characteristics of LTI system and various filters. (L2)
- Analyse filter characteristics and physical realisation of LTI system. (L4)
- Apply the relation between bandwidth and rise time & energy and power spectral densities in various applications. (L3)

UNIT – V (10 Hrs)

Laplace Transform: Definition, ROC, Properties, Inverse Laplace transforms, the S-plane and BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions.

Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, The inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the limitations of Fourier transform and need for Laplace transform and develop (L2)
- Apply transform techniques to analyse discrete-time signals and systems. (L3)
- Evaluate response of linear systems to known inputs by using Laplace transforms. (L4)
- Analyze the continuous-time and discrete-time signals and systems using Laplace and Z-transforms. (L4)

TEXTBOOKS:

1. "Signals and Systems", A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edition, 2009.
2. "Linear Systems and Signals", B. P. Lathi, Oxford University press, Second Edition

REFERENCE BOOKS:

1. "Fundamentals of Signals and Systems", Michel J. Robert, MGH International Edition, 2008.
2. "Schaum's Outline of Signals and Systems", Hwei Hsu, TMH, 4th Edition, 2019.
3. "Signals & Systems", Simon Haykin and Van Veen, Wiley, 2nd Edition, 2005
4. "Signals, Systems and Transforms", C. L. Philips, J. M. Parr and Eve A. Riskin, Pearson education

Course Code	PULSE AND DIGITAL CIRCUITS		L	T	P	C
21A040402			3	0	0	3
Pre-requisite	Electronic Devices & Circuits	Semester	III			

COURSE OBJECTIVES:

- To design low pass and high pass circuit RC networks.
- To design clippers and clampers.
- To analyse various multivibrators and sweep circuits.
- To understand the significance of number systems, conversions, binary codes and functionality of logic gates and logic families.
- To discuss different simplification methods for minimizing Boolean functions.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Design Low pass and High pass circuit RC networks.
CO2: Design diode Clipper and Clamper circuits.
CO3: Analyze various Multivibrators and Sweep circuits.
CO4: Utilize Boolean algebra, Number systems and Logic gates in the development of logic circuits.
CO5: Apply K-Map & Tabular methods to minimize logic functions.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	-	-	-	-	-	-	-	3	2	1
CO2	3	3	3	1	-	-	-	-	-	-	-	3	2	1
CO3	3	3	2	1	-	-	-	-	-	-	-	3	2	1
CO4	3	1	2	1	-	-	-	-	-	-	-	3	1	3
CO5	3	2	2	1	-	-	-	-	-	-	-	3	1	3

UNIT – I (10 Hrs)

Linear Wave shaping: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. High Pass RC network as Differentiator, Low Pass RC network as integrator, attenuators, and its applications as a CRO probe, RL and RLC circuits and their response for step input, Ringing circuit. Problem solving.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic working of Low pass and High pass circuits. (L2)
- Design different linear wave shaping circuits. (L5)

UNIT – II (10 Hrs)

Non-Linear Wave Shaping: Diode clippers, Transistor clippers, clipping at two independent levels, Comparators, applications of voltage comparators, clamping operation, clamping circuits taking source and Diode resistances into account, clamping circuit theorem, practical clamping circuits, Effect of diode characteristics on clamping voltage, Synchronized Clamping.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic working of Clippers and Clampers. (L2)
- Design different diode clippers and clamper. (L5)

UNIT – III (12 Hrs)

Multivibrator Circuits: Analysis and Design of Bistable, Monostable, Astable multivibrators and Schmitt trigger circuit using BJT. General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the principle of operation of the multivibrators. (L2)
- Analyse and Design of Multi-vibrator circuits and their applications. (L4)
- Understand Time-base generators. (L2)

UNIT – IV (14 Hrs)

Number System & Boolean Algebra: Decimal, Binary, Octal, and Hexa-decimal number systems and their conversions, complements of numbers, Signed binary numbers, Binary codes. Boolean Algebra-Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, other logic operations, Logic gates, Logic families (RTL, DTL, TTL, Schottky TTL, ECL and MOS) and Comparison.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize advantages of using different number systems. (L2)
- Explain usefulness of different coding schemes. (L2)
- Understand the functionality of logic gates and Logic families. (L2)

UNIT – V (13 Hrs)

Gate Level Minimization: The map method, four variable, K-map, Five variable map, POS & SOP Simplification, Don’t care conditions, NAND & NOR Implementation, Other two-level Implementation, Ex-or Function, Tabular Method- Simplification of Boolean function using tabulation Method.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic laws and De Morgan’s theorems to simplify Boolean expressions. (L3)
- Compare K- Map and Q-M methods of minimizing logic functions. (L5)

TEXTBOOKS:

1. “Millman’s Pulse, Digital and Switching Waveforms”, J. Millman, H. Taub and Mothiki S. Prakash Rao, TMH, 2nd Edition, 2008.
2. “Solid State Pulse Circuits”, David A. Bell, PHI, 4th edition, 2002.

3. “Digital Design”, M.Morris Mano & Michel D. Ciletti, Pearson ,5th Edition.
4. “Switching theory and Finite Automata Theory”, Zvi Kohavi and Nirah K. Jha, Cambridge, 3rd Edition

REFERENCE BOOKS:

1. “Pulse and Digital Circuits”, A. Anand Kumar, PHI, 2005.
2. “Fundamentals of Pulse and Digital Circuits”, Ronald J. Tocci, 3rd edition, 2008.
3. “Digital Electronics”, Subratha Goshal, Cambridge.
4. “Digital & State Machine Design”, Comer, OXFORD, Third Indian edition.

Course Code	PROBABILITY THEORY AND STOCHASTIC PROCESSES		L	T	P	C
21A040403			3	0	0	3
Pre-requisite	Calculus and Special Functions	Semester	III			

COURSE OBJECTIVES:

- To gain the knowledge of the basic probability concepts.
- To acquire skills in handling situations involving more than one random variable and functions of random variables.
- To gain knowledge of standard distributions that can describe real life phenomena.
- Make the difference between time averages and statistical averages.
- To understand the principles of random signals and random processes.
- To be acquainted with systems involving random signals.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Understanding the concepts of Probability, Random Variables, Random Processes and their characteristics learn how to deal with multiple random variables, conditional probability, joint distribution and statistical independence.

CO2: Formulate and solve the engineering problems involving random variables and random processes.

CO3: Analyze the concepts and its properties of auto-correlation, cross-correlation functions and power spectral density of Random Process.

CO4: Analyze various probability density functions of random variables.

CO5: Derive the response of linear system for Gaussian noise and random signals as inputs.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	2	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	2	-
CO3	3	2	2	3	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	2	-	-	-	-	-	-	-	1	2	-
CO5	3	2	2	2	-	-	-	-	-	-	-	1	2	-

UNIT – I (11 Hrs)

Probability Introduced Through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events, Problem Solving.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the fundamental concepts of probability theory and conditional probability (L2)

UNIT – II (15 Hrs)

Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous, Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Methods of defining Conditioning Event, Conditional Density, Properties, Problem Solving.

Operations on Single Random Variable: Introduction, Expectation of a random variable, moments-moments about the origin, Central moments, Variance and Skew, Chebyshev's inequality, moment generating function, characteristic function, transformations of random variable.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the fundamental concepts of random variables. (L2)
- Evaluate the different probability distribution and density functions. (L4)
- Apply the knowledge to the central limit theorem in communication system. (3)
- Evaluate the single random variable concepts to expectation, variance and moments. (L4)

UNIT – III (12 Hrs)

Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected), Unequal Distribution, Equal Distributions.

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments of the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties of Gaussian random variables, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the knowledge to the sum of random variables in communication system. (L3)
- Evaluate the multiple random variable concepts to expectation, variance and moments. (L4)
- Apply the different operations to multiple random variables. (L3)
- Understand the concepts of linear transformation of Gaussian random variables. (L2)

UNIT – IV (13 Hrs)

Random Processes-Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second Order and Wide-Sense Stationarity, N-Order and Strict-Sense Stationarity. Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

Random Processes-Spectral Characteristics: The Power Density Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum and its Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

Learning Outcomes: At the end of this unit, students should be able to

- Understand and analyze continuous and discrete-time random processes. (L2)
- Analyze the concepts and its properties of auto correlation, cross correlation functions and power spectral density. (L4)

UNIT – V (11 Hrs)

Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean squared Value of System Response, autocorrelation Function of Response, Cross Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band Limited and Narrowband Processes, Properties.

Noise Definitions: White Noise, colored noise and their statistical characteristics, Ideal low pass filtered white noise, RC filtered white noise.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the theory of stochastic processes to analyze linear systems. (L2)
- Apply the knowledge to linear systems; low pass and band pass noise models for random processes. (L3)

TEXTBOOKS:

1. "Probability, Random Variables & Random Signal Principles", Peyton Z. Peebles, TMH, 4th Edition, 2002.
2. "Probability, Random Variables and Stochastic Processes", Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.

REFERENCE BOOKS:

1. "Communication Systems", Simon Haykin, Wiley, 3rd Edition, 2010.

2. "Probability and Random Processes with Application to Signal Processing," Henry Stark and John W. Woods, Pearson Education, 3rd Edition, 2002.
3. "Probability Methods of Signal and System Analysis, George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999.

Course Code	ELECTRICAL TECHNOLOGY		L	T	P	C
21A020305			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- The constructional features of DC machines, different types of DC machines and their characteristic.
- The constructional details of single-phase transformer and their performance characteristics by conducting suitable tests.
- The analysis of three phases balanced and unbalanced circuits, three phase induction motors and their characteristics.
- The constructional feature and operation of synchronous machines.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Calculate the e.m.f. generated on DC Generator and analyzes the types of generators.
CO2: Analyze the various speed control techniques of DC motors.
CO3: Conduct open circuit and short circuit tests on single phase transformer for knowing their characteristics.
CO4: Analyze three phase circuits, three induction motor operating principle and know their torque slip characteristics.
CO5: Acquire knowledge on synchronous machine with which he/she can able to apply the above conceptual things to real-world problems and applications.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	1

UNIT – I (10Hrs)

DC Generators: D.C. Generators – Principle of Operation – Constructional Features – E. M.F Equation–Numerical Problems – Methods of Excitation – Separately Excited and Self Excited Generators – Build-Up of E.M.F - Critical Field Resistance and Critical Speed - Load Characteristics of Shunt, Series and Compound Generators- Applications

Learning Outcomes: At the end of this unit, students should be able to

- Know about principle of operation of a DC machine working as a generator (L2)
- Distinguish between self and separately excited generators and classification (L4)

- Know how emf is developed (L4)
- Distinguish between critical field resistance and critical speed (L4)
- Know about various characteristics of different types of generators (L4)

UNIT – II (10Hrs)

D.C. Motors: D.C Motors – Principle of Operation – Back E.M.F. –Torque Equation – Characteristics and Application of Shunt, Series and Compound Motors-Speed Control of D.C. Motors: Armature Voltage and Field Flux Control Methods. Three Point Starter-Losses – Constant & Variable Losses – Calculation of Efficiency - Swinburne's Test.

Learning Outcomes: At the end of this unit, students should be able to

- Know about principle of operation of DC machine working as a motor (L2)
- Know about torque developed (L4)
- Know about how to control speed of DC shunt motor (L3)
- Know about necessity of starter (L2)
- Know about various load characteristics of various types of DC motors (L3)

UNIT – III (10Hrs)

Single Phase Transformers & Three Phase A.C. Circuits: Introduction - Single Phase Transformers- Constructional Details- Emf Equation - Operation on No Load and on Load - Phasor Diagrams-Equivalent Circuit - Losses and Efficiency-Regulation- OC and SC Tests - Predetermination of Efficiency and Regulation. Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principle of operation of 1-ϕ transformer (L2)
- Understand computation and predetermination of regulation of a 1-ϕ transformer (L2)
- Know about basics of three phase circuits (L2)
- Distinguish between phase voltages, currents, line values and phase values (L4)
- Distinguish between balanced and unbalanced three phase circuits and power Measurement (L4)

UNIT – IV (10Hrs)

3-Phase Induction Motors: Poly phase Induction Motors-Construction Details of Cage and Wound Rotor Machines-- Principle of Operation – Slip- Rotor Emf and Rotor Frequency - Torque Equation- Torque Slip Characteristics – Losses and efficiency.

Learning Outcomes: At the end of this unit, students should be able to

- Know about principle of operation of three phase induction motor (L2)

- Distinguish between squirrel cage and slip ring induction motors (L4)
- Know about various losses and computation of efficiency of induction motor (L4)
- Know about the torque developed by the induction motor (L4)
- Understand various characteristics of induction motor (L2)

UNIT – V(10Hrs)

Synchronous Machines: Principle and Constructional Features of Salient Pole and Round Rotor Machines – E.M.F Equation- Voltage Regulation by Synchronous Impedance Method- Theory of Operation of Synchronous Motor

Learning Outcomes: At the end of this unit, students should be able to

- Know about principle of working of alternator. (L2)
- Distinguish between salient pole and cylindrical rotor machines (L4)
- Know about emf equation. (L4)
- Know about predetermination of regulation of alternator by synchronous impedance method. (L4)
- Know about principle of operation of synchronous motor. (L4)

TEXTBOOKS:

1. "Electric Machines", I. J. Nagrath & D. P. Kothari, Tata Mc Graw Hill, 7th Edition, 2005
2. "Basic Electrical Engineering", T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 3rd Edition, 2017.

REFERENCE BOOKS:

1. "Fundamentals of Electric Machines", B. R. Gupta, Vandana Singhal, New age International Publishers, 3rd Edition, 2005.
2. "Electromechanics – III", S. Kamakashiah, Overseas Publishers Pvt. Ltd.
3. "Principles of Electrical Engineering", V.K. Mehta and Rohit Mehta, S. Chand Publications, 2005

Course Code	PULSE AND DIGITAL CIRCUITS LAB		L	T	P	C
21A040404			0	0	3	1.5
Pre-requisite	Electronic Devices & Circuits	Semester	III			

COURSE OBJECTIVES:

- To understand and design RC circuits as Integrator and differentiator.
- To verify various clipping and clamper circuits using PN junction diode.
- To Analyse and design of various multivibrator and sweep circuits.
- To understand fundamentals of basic logic gates and its applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze RC circuits with different time constants.
CO2: Analyze different clipping and clamper circuits.
CO3: Analyze and design of various multivibrator and sweep circuits.
CO4: Design simple digital circuits using logic gates.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	3	2	-	3	1	3
CO2	3	3	2	2	-	-	-	-	3	2	-	3	1	3
CO3	3	3	2	2	-	-	-	-	3	2	-	3	1	3
CO4	3	3	3	2	-	-	-	-	3	2	-	3	1	3

LIST OF EXPERIMENTS:

1. Linear wave shaping (RC Integrator & RC differentiator).
2. Non-Linear wave shaping – Clippers.
3. Non-Linear wave shaping – Clampers.
4. Bistable Multivibrator.
5. Astable Multivibrator.
6. Monostable Multivibrator.
7. Schmitt Trigger.
8. UJT Relaxation Oscillator.
9. Bootstrap sweep circuit.
10. Constant Current Sweep Generator using BJT.
11. Study of Logic Gates.
12. Realization of Binary to Gray code Converter.

LIST OF EXPERIMENTS BEYOND THE CURRICULUM:

1. Astable Multivibrators Using 555 IC.
2. Monostable Multivibrators Using 555 IC.
3. Logic Gates using DL.

Tools / Equipment Required:

1. Licensed simulation software/DC Power supplies, Multi meters, Function generator, CROs and all the required active devices.

NOTE: The students are required to design the circuit and they have to perform the analysis through simulator using Pspice/Equivalent Licensed simulation software tool. Further they are required to verify the result using necessary hardware in the hardware laboratory.

Course Code	BASIC SIMULATION LAB		L	T	P	C
21A040405			0	0	3	1.5
Pre-requisite	Signals and Systems	Semester	III			

COURSE OBJECTIVES:

- To provide practical exposure with generation and simulation of basic signals using standardized tools.
- To teach analysing signals and sequences using Fourier, Laplace and Z-transforms.
- To enable to write programs for signal processing applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the basic concepts of programming in MATLAB and use of built-in functions to perform assigned task.
CO2: Generate signals and sequences, input signals to the systems to perform various operations
CO3: Analyze signals using Fourier, Laplace and Z-transforms.
CO4: Verify Sampling theorem and Determine convolution and Correlation between signals and sequences.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	3	2	-	2	3	1
CO2	3	3	3	2	-	-	-	-	3	2	-	2	3	1
CO3	3	3	3	2	-	-	-	-	3	2	-	2	3	-
CO4	3	3	3	2	-	-	-	-	3	2	-	2	3	-

LIST OF EXPERIMENTS:

1. Write a program to generate various Signals and Sequences: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc function.
2. Perform operations on Signals and Sequences: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Write a program to find the trigonometric & exponential Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightages - Plot the discrete spectrum of the signal.
4. Write a program to find Fourier transform of a given signal. Plot its amplitude and phase spectrum.
5. Write a program to convolve two discrete time sequences. Plot all the sequences.
6. Write a program to find autocorrelation and cross correlation of given sequences.
7. Write a program to verify Linearity and Time Invariance properties of a given Continuous/Discrete System.

8. Write a program to generate discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.
9. Write a program to find magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.
10. Write a program to find response of a low pass filter and high pass filter, when a speech signal is passed through these filters.
11. Write a program to generate Complex Gaussian noise and find its mean, variance, Probability Density Function (PDF) and Power Spectral Density (PSD).
12. Generate a Random data (with bipolar) for a given data rate (say 10kbps). Plot the same for a time period of 0.2 sec.
13. To plot pole-zero diagram in S-plane/Z-plane of given signal/sequence and verify its stability.

Note: All the experiments are to be simulated using MATLAB or equivalent software

Course Code	ELECTRICAL TECHNOLOGY LAB		L	T	P	C
21A020306			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To do experiments on DC generators and experiments on DC motors
- To do experiments on 1-ϕ transformer
- To do power measurements in 3-ϕ balanced and unbalanced circuits
- To do tests on 3-ϕ Induction motors
- To do experiment on Alternator and experiment on Synchronous motor

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand various characteristics of DC generators and DC motors.
CO2: Predetermine the efficiency and regulation of a 1-ϕ transformer.
CO3: Determine power measurement in 3-ϕ circuits.
CO4: Understand various characteristics of Induction motors and Synchronous Machines.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	1	1	-	1	-	1
CO2	3	2	1	1	-	-	-	-	1	1	-	1	-	1
CO3	3	2	1	1	-	-	-	-	1	1	-	1	-	1
CO4	3	2	1	1	-	-	-	-	1	1	-	1	-	1

LIST OF EXPERIMENTS:

1. OCC of a separately excited DC generator
2. Load characteristics of DC shunt generator
3. Load characteristics of DC shunt motor
4. Swinburne’s test
5. Speed control of DC shunt motor
6. OC & SC tests on a 1-ϕ transformer
7. Measurement of Active and reactive powers in a 3-ϕ balanced circuit
8. Measurement of 3-ϕ power using two wattmeter methods in unbalanced circuit
9. Load test on Squirrel cage Induction motor
10. Load test on Slip ring Induction motor
11. Predetermination of regulation of alternator by Synchronous impedance method
12. V and Inverted V curves of Synchronous motor

Note: Student must perform at least 10 experiments

Course Code	PYTHON PROGRAMMING		L	T	P	C
21A050701	(Common to CE, EEE, ME & ECE)		1	0	2	2
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- To understand the object-oriented concepts using Python in problem solving.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Student should be able to understand the basic concepts of Python Programming language such as conditional processing, Loops, and other data structures.

CO2: Ability to explore python especially the built-in objects of Python.

CO3: Ability to create practical and contemporary applications such as Machine Learning algorithms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	3	2
CO2	2	2	2	1	3	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	3	-	-	-	-	-	-	-	3	2

Topics to be covered:

Introduction: What is a program, running python, Arithmetic operators, Value and Types.

Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.

Functions: Function Definitions and Uses, Math functions,

Conditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Recursion, Keyboard input.

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, it's Looping

Tuples: Tuples are immutable, Tuple Assignment

Files: Persistence, Reading and writing, Format operator, Filename and paths,

Classes and Objects: Programmer-defined types, Classes, Objects, methods and modules.

The turtle module & tkinter module: graphics-based Object shapes drawing fundamentals, GUI design Fundamentals

LABORATORY EXPERIMENTS:

1. Install Python Interpreter and use it to perform different Mathematical Computations.
2. Write a Python Program to find sum of given n numbers
3. Write a Python Program to generate Fibonacci Numbers up to a given number
4. Write a Python Program to display multiplication Table of a given Number
5. Write a Python Program to read a list of names from keyboard, sort them and write them into a File
6. Write a Python Program to concatenate two files content and write the result into a new File.
7. Write a Python Program to perform the addition of two matrices.
8. Write a Python Program to search a given word in the given text file and display the number of occurrences of the string.
9. Write the step-by-step Solution procedure to find the LCM and GCD (HCF) of 2 given numbers
10. Find mean, median, mode for the given set of numbers in a list
11. Python Code to create module called "mathematics" having functions add (), subtract(), div(), mul() and access them by another Program.
12. Develop Python program for illustrating the object-oriented features supported by Python
13. Write a function that draws a Pyramid with #symbols

```
      #
     # ##
   # # # ##
 # # # # # ##
```

up to 15 hashes at the bottom

14. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Use object-oriented approach.
15. Using turtles concept draw Olympic Symbol
16. The time module provides a function, also named time that returns the current Greenwich Mean Time in "the epoch", which is an arbitrary time used as a reference point

    a. >>> import time
    b. >>>time.time () 14377460
        a. 94.5735958

17. Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.
18. Given a text of characters, write a program which counts number of vowels, consonants and special characters.
19. Write program which performs the following operations on list's. Don't use built-in functions
    a) Updating elements of a list
    b) Concatenation of list's
    c) Check for member in the list
    d) Insert into the list
    e) Sum the elements of the list
    f) Push and pop element of list
    g) Sorting of list
    h) Finding biggest and smallest elements in the list
    i) Finding common elements in the list
20. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.
21. Develop Python Program to create Login Screen and evaluate user Input?

TEXTBOOKS:

1. "Think Python", Allen B. Downey, SPD/O'Reilly, 2nd edition, 2016.

REFERENCE BOOKS:

1. "The Complete Reference: Python", Martin C. Brown, McGraw-Hill, 2018.
2. "Fundamentals of Python", Kenneth A. Lambert, B.L. Juneja, CENGAGE, 2015.
3. "Core Python Programming", R. Nageswara Rao, Dreamtech Press, 2nd edition, 2019

Course Code	**CONSTITUTION OF INDIA**		**L**	**T**	**P**	**C**
21A000002	(Common to all branches)		**2**	**0**	**0**	**0**
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand historical background of the constitution making and its importance for building a democratic India. **(K2)**

CO2: Understand the functioning of three wings of the government i.e., executive, legislative and judiciary. **(K2)**

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India. **(K2)**

CO4: Analyze the decentralization of power between central, state and local self-government **(K4)**

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO2	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO3	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO4	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO5	-	-	-	-	-	3	-	2	1	-	-	1	-	-

UNIT – I (9 Hrs)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution-Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Indian constitution (L1)
- Apply the knowledge on directive principle of state policy (L3)
- Analyze the History and features of Indian constitution (L4)
- Learn about Preamble, Fundamental Rights and Duties (L1)

UNIT – II (9 Hrs)

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of Indian government (L1)
- Differentiate between the state and central government (L4)
- Explain the role of President and Prime Minister (L2)
- Know the Structure of supreme court and High court (L1)

UNIT – III (9 Hrs)

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of state government (L1)
- Analyze the role of Governor and Chief Minister (L4)
- Explain the role of State Secretariat (L2)
- Differentiate between structure and functions of state secretariat (L4)

UNIT – IV (9 Hrs)

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning Outcomes: At the end of this unit, students should be able to

- Understand the local Administration (L1)
- Compare and contrast district administration's role and importance (L4)
- Analyze the role of Mayor and elected representatives of Municipalities (L4)
- Learn about the role of Zilla Parishath block level organization (L1)

UNIT – V (9 Hrs)

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Learning Outcomes: At the end of this unit, students should be able to

- Know the role of Election Commission (L1)

- Contrast and compare the role of Chief Election commissioner and Commissionerate (L4)
- Analyze the role of state election commission (L4)
- Evaluate various commissions viz SC/ST/OBC and women (L6)

TEXTBOOKS:

1. "Introduction to the Constitution of India", Durga Das Basu, Prentice Hall of India Pvt. Ltd. New Delhi
2. "Indian Constitution", Subash Kashyap, National Book Trust

REFERENCE BOOKS:

1. "Dynamics of Indian Government & Politics", J.A. Siwach,
2. "Constitutional Law of India", H.M.Sreevai, 4th edition in 3 volumes (Universal Law Publication)
3. "Indian Government and Politics", J.C. Johari, Hans India

Course Code	CONTROL SYSTEMS		L	T	P	C
21A040303			3	0	0	3
Pre-requisite	Mathematical Methods	Semester	IV			

COURSE OBJECTIVES:

- Merits and demerits of open loop and closed loop systems; the effect of feedback
- The use of block diagram algebra and Mason's gain formula to find the overall transfer function
- Transient and steady state response, time domain specifications and the concept of Root loci
- Frequency domain specifications, Bode diagrams and Nyquist plots
- State space modelling of Control system

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic principles of systems and their mathematical Representations.

CO2: Analyse time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.

CO3: State space formulation for obtaining mathematical and Root locus.

CO4: Understand the Bode, Nyquist, and Polar plots for stability calculations, Design and develop different compensators, controllers.

CO5: Analyze the stability concepts, state space models, controllability and observability for demonstrate the use of these techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	2	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	2	1	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	1	-	-	-	-	-	-	-	-	2	1	-
CO5	3	3	1	-	-	-	-	-	-	-	-	2	1	-

UNIT – I (12 Hrs)

Control Systems Concepts: Open loop and closed loop control systems and their differences-Examples of control systems Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula.

Learning Outcomes: At the end of this unit, students should be able to

- Write the differential equations for mechanical and electrical systems. (L3)
- Obtain the transfer function from block diagrams, servo motors and signal flow graphs

UNIT – II (12 Hrs)

Time Response Analysis: Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the time domain specifications (L4)
- Calculate the steady state errors (L3)
- Understand about Proportional, Integral and Derivative controllers along with combinations (L2)

UNIT – III (13 Hrs)

Stability Analysis in Time Domain: The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the concept of stability in time domain (L4)
- Apply the concept of Routh's stability and Root locus in time domain (L3)

UNIT – IV (11 Hrs)

Frequency Response Analysis: Introduction, Frequency domain specifications-Bode Diagrams-Determination of Frequency domain specifications. Polar Plots-Nyquist Plots- Phase margin and Gain margin.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate the frequency domain specifications from Bode, Polar and Nyquist plots (L4)
- Design Compensators for various systems (L5)
- Deducing transfer functions from Bode Plots (L4)
- Understand difference between Phase and Gain margins (L2)

UNIT – V (12 Hrs)

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations-State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of state space, controllability, and observability (L2)
- Obtain the transfer function from sate space and vice versa (L3)
- Understand the state transition method of solving time invariant state equations (L2)

TEXTBOOKS:

1. "Modern Control Engineering", Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. "Control Systems Engineering", I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th edition, 2007.

REFERENCE BOOKS:

1. "Control Systems Principles & Design", M. Gopal, Mc Graw Hill Education, 4th Edition, 2012.
2. "Automatic Control Systems", B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
3. "Schaum's outlines Feedback and Control Systems", Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, Mc Graw Hill Education, 2nd Edition, 2013.
4. "Control System Design", Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. "Feedback Control of Dynamic Systems", Gene F. Franklin J.D. Powell and Abbas Emami-Naeini, Pearson, 6th Edition, 2010.

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all branches)		L	T	P	C
21A110203			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To know the various types of Market Structures & pricing methods and its strategies.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Analyse the consumer behaviour with regard to their product or services and measure demand of a particular product or services by applying various methods in given situation

CO2: Determine Break Even Point (BEP) of an enterprise Assess the cost behaviour, costs useful for managerial decision making

CO3: Determine the price of a product or services in given market condition

CO4: Analyze the financial position by using different types of ratios and interpret the financial accounting

CO5: Evaluate the investment proposals under payback period, ARR, IRR, NPV & PI methods

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT- I (11 Hrs)

Introduction to Managerial Economics and Demand Analysis: Managerial Economics– Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand- Demand Forecasting- Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Learning Outcomes: At the end of this unit, students should be able to

- Know the nature and scope of Managerial Economics and its importance. (L1)
- Understand the concept of demand and its determinants. (L2)
- Analyse the elasticity and degree of elasticity. (L4)
- Evaluate demand forecasting methods. (L5)
- Design the process of demand estimation for different types of demand. (L6)

UNIT- II (10 Hrs)

Theory of Production and Cost Analysis:

Production Function – Short-run and Long-run Production Function -Isoquants and Iso costs, MRTS –Least cost combination of Inputs, Cobb-Douglas Production Function - Laws of Returns – Internal and External Economies of scale – **Cost & Break-Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA)–Determination of Break-Even Point (Simple Problems)-Managerial significance of Break-Even Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, Input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)
- Develop Profit appropriation for different levels of business activity. (L6)

UNIT- III (11 Hrs)

Introduction to Markets and New Economic Environment:

Market structures Types of Markets-Perfect and Imperfect Competition- Features of Perfect Competition– Monopoly -Monopolistic Competition –Oligopoly-Price-Output Determination-Pricing Methods and Strategies- Forms of Business Organizations - Sole Proprietorship - Partnership – Joint Stock Companies-Public Sector Enterprises - New economic Environment - **Economic Liberalization – Privatization – Globalization.**

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know the production function, input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)

UNIT- IV (10 Hrs)

Capital and Capital Budgeting: Concept of Capital-Significance-Types of Capital-Components of Working Capital - Sources of Short-term and Long-term Capital -Estimating Working capital requirements-**Capital Budgeting**–Features of Capital Budgeting Proposals – Methods and

Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept of Capital Budgeting and its importance in business (L1)
- Contrast and compare different investment appraisal methods. (L4)
- Analyse the process of selection of investment alternative using different appraisal methods. (L4)
- Evaluate methods of Capital budgeting techniques. (L5)
- Design different investment appraisals and make wise investments. (L6)

UNIT–V (10 Hours)

Introduction to Financial Accounting and Analysis: Financial Accounting – Concept – Emerging need and Importance - Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet (with simple adjustments). ***Financial Analysis*** **-** Ratios- Liquidity, Leverage, Profitability and Activity Ratios (Simple Problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept and convention and significance of accounting. (L1)
- Apply the fundamental knowledge of accounting while posting the Journal entries. (L3)
- Analyze the process and preparation of Financial Accounts and Financial Ratios. (L4)
- Evaluate the Financial performance of an enterprise by using financial statements. (L5)

TEXTBOOKS:

1. "Managerial Economics", Varshney & Maheswari, S. Chand, 2013.
2. "Managerial Economics and Financial Analysis", Aryasri, MGH, 4th edition, 2019

REFERENCE BOOKS:

1. "Managerial economics", Ahuja HL, S. Chand, 3rd edition, 2013.
2. "Managerial Economics and Financial Analysis", S. A. Siddiqui and A. S. Siddiqui, New Age International, 2013.
3. "Principles of Business Economics", Joseph G. Nellis and David Parker, Pearson, 2nd edition, New Delhi.
4. "Managerial Economics in a Global Economy", Dominick Salvatore, Cengage Learning, 2013.

Course Code	DIGITAL SYSTEM DESIGN		L	T	P	C
21A040406			3	0	0	3
Pre-requisite	Pulse and Digital Circuits	Semester	IV			

COURSE OBJECTIVES:

- To be able to use computer-aided design tools for development of complex digital logic circuits.
- To illustrate the concepts and study the procedures for the analysis and design of combinational circuits and sequential circuits.
- To introduce the concepts of programmable logic devices.
- To be able to model and simulate with hardware description languages.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Explain the concepts of VHDL language.
CO2: Design and implement various combinational circuits using VHDL.
CO3: Design and implement various sequential circuits using VHDL.
CO4: Explain error detection and correction techniques.
CO5: Design Digital systems.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3	-	3

UNIT – I (12 Hrs)

Hardware Description Languages: HDL Based Digital Design, The VHDL Hardware Description Language–Program Structure, Types, Constants and Arrays, Functions and procedures, Libraries and Packages, Structural design elements, Dataflow design elements, Behavioral design elements, The Time Dimension, Simulation, Test Benches, VHDL Features for Sequential Logic Design, Synthesis.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various data types used in VHDL language. (L2)
- Understand the VHDL operators and apply them in digital design. (L2)
- Explain various VHDL models to implement digital circuits. (L2)

UNIT – II (14 Hrs)

Combinational Circuits: Combinational circuits, Analysis & Design procedure, Binary Adder-subtractor, Decimal Adder, Binary Multiplier, Magnitude comparator, Decoder, Encoders, Multiplexers (74 –series MSI) and Designing Using combinational PLDs like PLAs, PALs, PROMs CMOS PLDs and their VHDL models.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Boolean algebra for describing combinational digital circuits. (L3)
- Analyse standard combinational circuits such as adders, subtractors, multipliers, comparators etc. (L4)
- Design of digital circuits using PLD structures. (L5)
- Use VHDL in design of combinational logic circuits to analyse the behaviour. (L4)

UNIT – III (12 Hrs)

Sequential Circuits: Sequential Circuits, Latches Flips-Flops, Analysis of Clocked sequential circuits, State Reduction & Assignment, Design procedure, Registers & Counters – Registers, Shift Registers, Ripple Counters, Synchronous counters, other counters (Ring counters; Johnson counters, LFSR counter) (74 –series MSI) and their VHDL models.

Learning Outcomes: At the end of this unit, students should be able to

- Describe behaviour of Flip-Flops and Latches. (L2)
- Compare Moore and Mealy machine models. (L4)
- Utilize concepts of state and state transition for analysis and design of sequential circuits (L3)
- Implementation of different sequential circuits using VHDL. (L3)

UNIT – IV (13 Hrs)

Asynchronous Sequential Logic: Introduction, Analysis Procedure, Circuits with Latches, Design Procedure, Reduction of State flow tables, Race-free State Assignment, Hazards. Types of memories, Memory Decoding, Error detection and correction.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts State Flow tables, Race-free State Assignment and Hazards. (L2)
- Describe functional differences between different types of RAM & ROM. (L2)
- Explain error detection and correction techniques. (L2)

UNIT – V (11 Hrs)

Design Examples (Using VHDL): Barrel shifter, Comparators, Floating-point encoder, and Dual parity encoder.

Learning Outcomes: At the end of this unit, students should be able to

- Design different digital systems. (L5)

- Develop VHDL models for various digital Systems. (L5)

TEXTBOOKS:

1. "Digital Design Principles and Practices", John F. Wakerly, Pearson Education., 4th edition, 2009
2. "Fundamentals of Logic Design", Charles H.Roth Jr., CENGAGE Learning, 5th edition , 2012.
3. "Digital Design", M. Morris Mano & Michel D. Ciletti, Pearson, 5th Edition.

REFERENCE BOOKS:

1. "Digital Logic Design", M. Morris Mano and Michael D. Cilleti., Pearson Education., 4th edition, 2013
2. "Fundamentals of digital logic with VHDL design", Stephen Brown and Zvonko Vranesic, McGraw Hill Higher Education, 2nd edition.
3. "A VHDL PRIMER", J. Bhasker, PHI Learning, 3rd edition, Eastern Economy Edition, 2010.
4. "Switching theory and Finite Automata Theory", Zvi Kohavi and Nirah K. Jha, Cambridge, 3rd Edition.

<table>
<tr><td>Course Code</td><td rowspan="2">ELECTRONIC CIRCUITS ANALYSIS AND DESIGN</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A040407</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Electronic Devices and Circuits</td><td>Semester</td><td colspan="4">IV</td></tr>
</table>

COURSE OBJECTIVES:

- To design and analyze single and multi-stage amplifiers using BJT & FET at low and high frequencies.
- To explain effect of negative feedback on amplifier characteristics.
- To teach basic principles for analysing RC & LC oscillator circuits.
- To introduce different types of large signal amplifiers and tuned amplifiers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyse low frequency BJT & FET amplifiers using hybrid pie model.

CO2: Analyse the frequency response of single stage amplifiers at high and low frequencies.

CO3: Analyze and examine few common two stage transistor amplifier circuits viz., Cascade amplifiers, Cascode amplifiers, Darlington pairs.

CO4: Analyse and examine the characteristics of various types of feedback configurations and Oscillators.

CO5: Analyse different types of power amplifier and Tuned amplifiers.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	3	1	3
CO2	3	3	2	1	-	-	-	-	-	-	-	3	1	3
CO3	3	3	2	2	-	-	-	-	-	-	-	3	2	3
CO4	3	3	2	2	-	-	-	-	-	-	-	3	2	3
CO5	3	3	2	2	-	-	-	-	-	-	-	3	3	3

UNIT – I (12 Hrs)

BJT Small Signal Models: Bipolar linear amplifier, Graphical and ac equivalent circuit, Small signal hybrid-∏ equivalent circuit, Hybrid-∏ equivalent circuit including the early effect, other small signal parameters and equivalent circuits-h-parameters.

Small Signal Analysis: Basic CE amplifier circuit, Circuit with Emitter resistance, ac load line analysis, maximum symmetrical swing, Small signal analysis-input and output impedances, Voltage gain, Current gain of CB, CC amplifiers, Problem solving.

Small Signal Amplifiers Using JFET/MOSFETS: Graphical analysis, Load line and small signal parameters, Small signal equivalent circuit, Small signal analysis of Common source, Common drain, Common gate amplifiers, Comparison of the three basic amplifier configurations, Problem solving.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts and equivalent circuit models of small signal amplifiers. (L2)
- Analyse low frequency models of BJT and FET. (L4)
- Design BJT and FET amplifier circuits. (L5)
- Determine performance parameters of BJT and FET amplifiers. (L2)

UNIT – II (12 Hrs)

Frequency Response: Amplifier frequency response-different ranges, short circuit and open circuit time constants, time response, transistor amplifiers with circuit capacitors-coupling capacitor effects, load capacitor effects, Bypass capacitor effects, Problem solving, combined effects of coupling and bypass capacitor, high-frequency response model for BJT and MOSFETs, short circuit current gain, Miller effect and its applications, unity-gain bandwidth in BJT and FET amplifiers.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the frequency response of single stage amplifiers using BJT & FET at high and low frequencies. (L4)
- Design of single stage amplifiers using BJT and FET with and without coupling capacitors. (L5)
- Explore the various effects of load, bypass and coupling capacitor on the performance of amplifier circuits. (L3)

UNIT- III (12 Hrs)

Multistage Amplifiers: Classification of amplifiers, Methods of coupling, Analysis of two stage RC coupled amplifier, Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower, Analysis of multi stage amplifiers using FET, Differential amplifier using BJT.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the classification of Amplifiers. (L2)
- Understand different coupling methods and their importance. (L2)
- Analyse different multistage configurations. (L4)

UNIT – IV (12 Hrs)

Feedback Amplifiers: General Considerations, Properties of Negative Feedback, Types of Amplifiers, Sense and Return Techniques, Polarity of Feedback, Feedback Topologies, Effect of Nonideal I/O Impedances, Stability in Feedback Systems, Analysis of a feedback Amplifiers - Voltage – Series, Current Series, Current-shunt and Voltage-shunt, Illustrative problems.

Oscillators: General Considerations, LC Oscillators, Phase Shift Oscillator, Wien-Bridge Oscillator, Crystal Oscillators, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand concept of different feedback topologies. (L2)

- Determine the effect of feedback on amplifier characteristics. (L2)
- Analyse characteristics of various types of feedback configurations (L4)
- Explore working principle of oscillator. Also examine different types of oscillators, RC & LC, with detailed mathematical analysis and illustrations. (L3)

UNIT – V (13 Hrs)

Power Amplifiers: Classes of amplifiers-Operations of Class A, B, AB, C, class-A: Inductively coupled amplifier, transformer-coupled common emitter amplifier, transformer-coupled emitter-follower amplifier, Class-AB Push-pull complementary output stages-class-AB output stage with diode biasing, class-AB biasing using the VBE multiplier, class-AB output stage with input buffer transistors, class –AB output stage utilizing the Darlington configuration, Illustrative Problems.

Tuned Amplifiers: Introduction to tuned amplifiers, Role of Q-Factor, Single-tuned, Double tuned and Stagger-tuned amplifiers.

Learning Outcomes: At the end of this unit, students should be able to

- Know most common classes of power amplifier and their basic characteristics. (L2)
- Analyse complementary symmetry topologies. (L4)
- Evaluate conversion efficiency of various topologies. (L4)
- Understand the working of different types of Tuned amplifiers (L2)

TEXTBOOKS:

1. “Electronic Circuits – Analysis and Design”, Donald A Neamen, McGraw Hill (India), 3rd Edition, 2019.
2. “Integrated Electronics”, J. Millman, C Chalkias, McGraw Hill Education (India) Private Ltd., 4th Edition, 2015.

REFERENCE BOOKS:

1. “Fundamentals of Micro Electronics”, Behzad Razavi, Wiley, 2010.
2. “Pulse, Digital and Switching Waveforms”, Millman and Taub, Tata McGraw-Hill Education, 3rd Edition, 2011
3. “Electronic Devices and Circuits Theory”, Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, 9th Edition, 2006.
4. “Electronic Circuit Analysis”, K. Lal Kishore, B S Publications, 2nd Edition, 2008.

Course Code	ANALOG COMMUNICATIONS		L	T	P	C
21A040408			3	0	0	3
Pre-requisite	Signals and Systems, Electronic Devices and Circuits	Semester	IV			

COURSE OBJECTIVES:

- To introduce various modulation and demodulation techniques of analog communication system.
- To analyze different parameters of analog communication techniques.
- Know Noise Figure in AM & FM receiver systems.
- Understand Function of various stages of AM, FM transmitters and know characteristics of AM & FM receivers.
- Understand the concepts of information theory.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the Frequency spectra of Modulated signals used in various Amplitude modulation schemes.

CO2: Analyze the Frequency spectra of Modulated signals used in various Angle modulation schemes.

CO3: Compare the performance of communication systems by evaluating Figure of Merit for different modulation schemes.

CO4: Compare the performance of different Analog Pulse modulation schemes.

CO5: Analyze the Channel performance using information theory.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	2	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	2	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	3	3	3

UNIT – I (13 Hrs)

Introduction: Elements of communication systems, Information, Messages and Signals, Modulation, Modulation Methods, Modulation Benefits and Applications.

Amplitude Modulation & Demodulation: Baseband and carrier communication, Amplitude Modulation (AM), Rectifier detector ,Envelope detector, Double sideband suppressed carrier (DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Frequency mixer, sideband and carrier power of AM, Generation of AM signals, Single sideband (SSB) transmission, Time domain representation of SSB signals & their demodulation schemes (with carrier and suppressed carrier), Generation of SSB signals, Vestigial sideband (VSB) modulator & demodulator, Frequency division multiplexing (FDM), Illustrative

Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Amplitude Modulation and demodulation techniques. (L2)
- Apply the concepts to solve problems in Amplitude modulation Schemes. (L3)
- Analyse frequency spectra of modulated signals used in various amplitude modulation (L4)
- Compare the Performance of different amplitude modulation techniques. (L4)

<u>UNIT – II</u> (12 Hrs)

Angle Modulation & Demodulation: Concept of instantaneous frequency, Generalized concept of angle modulation, Bandwidth of angle modulated waves–Narrow band frequency modulation (NBFM) and Wide band FM (WBFM), Phase modulation, Verification of Frequency modulation bandwidth relationship, Features of angle modulation, Generation of FM waves-Indirect method, Direct generation; Demodulation of FM, Band pass limiter, Practical frequency demodulators, Small error analysis, Pre-emphasis & De-emphasis filters, FM Capture Effect, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Angle modulation and demodulation techniques. (L2)
- Understand importance Pre-emphasis & de-emphasis circuit in FM modulation. (L2)
- Apply the concepts to solve problems in Angle modulation Schemes. (L3)
- Analyse frequency spectra of modulated signals used in various angle modulation(L4)

<u>UNIT – III</u> (11 Hrs)

Noise in Communication Systems: Thermal noise, Time domain representation of narrow band noise, filtered white noise, Quadrature representation of narrow band noise, Envelope of narrow band noise plus sine wave, Signal to noise ratio & probability of error, Noise equivalent bandwidth, Effective noise temperature, and Noise figure, Baseband systems with channel noise, Performance analysis (i.e. finding SNR expression) of AM, DSB-SC, SSB-SC, FM, PM in the presence of noise, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different types of noise and sources that effect the performance of the communication system. (L2)
- Analyse performance of analog communication system in the presence of noise. (L4)
- Compare the performance of communication system by evaluating figure of merit for different schemes of modulation. (L4)

<u>UNIT – IV</u> (10 Hrs)

Analog Pulse Modulation Schemes: Pulse amplitude modulation – Natural sampling, flat-top sampling and Pulse amplitude modulation (PAM) & demodulation, Pulse-Time Modulation – Pulse Duration and Pulse Position modulations, and demodulation schemes, PPM spectral analysis, Illustrative Problems.

Radio Receiver: Working principle of Super heterodyne AM and FM Receivers along with suitable block diagrams, Sensitivity, Selectivity and fidelity.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Analog Pulse Modulation and Demodulation techniques. (L2)
- Understand the concepts of AM and FM receivers. (L2)
- Apply the concepts to solve problems in Analog pulse modulation schemes. (L3)
- Analyse the performance of AM and FM receivers. (L4)
- Compare the Performance of different Analog Pulse Modulation techniques. (L4)

UNIT – V (13 Hrs)

Information Theory: Introduction, Information and Entropy, and its properties, source coding Theorem, Data Compaction – Prefix coding, Huffman coding, Discrete Memoryless channels, Mutual Information, and its properties, Channel capacity, Channel coding Theorem, Application to binary symmetric channels, differential entropy and mutual information, Information capacity theorem, implication of information capacity theorem, Rate Distortion, Illustrative problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of information theory and different coding techniques. (L2)
- Analyse Binary symmetric channel. (L4)
- Design the channel performance using information theory. (L5)
- Derive equation for Entropy, Mutual information and channel capacity for all types of channels. (L3)

TEXTBOOKS:

1. “Modern Digital and Analog Communication Systems”, B. P. Lathi, Oxford Univ. Press, 3rd Edition, 2006.
2. “Communication Systems”, John Wiley & Sons, Simon Haykin, 3rd Edition, 2010.
3. “Digital and Analog Communication Systems”, Sham Shanmugam, Wiley-India edition, 2006.

REFERENCE BOOKS:

1. “Communication Systems – An Introduction to Signals & Noise in Electrical Communication”, Bruce Carlson, & Paul B. Crilly, McGraw-Hill International Edition, 5th Edition, 2010.
2. “Principles of Communication Systems”, Herbert Taub & Donald L Schilling, Tata McGraw-Hill, 3rd Edition, 2009.
3. “Principles of Communication – Systems Modulation & Noise”, R. E. Ziemer & W. H. Tranter, Jaico Publishing House, 5th edition, 2001.
4. “Electronics & Communication System”, George Kennedy and Bernard Davis, TMH, 2004.

Course Code	DIGITAL SYSTEM DESIGN LAB		L	T	P	C
21A040409			0	0	3	1.5
Pre-requisite	Pulse and Digital Circuits	Semester	IV			

COURSE OBJECTIVE:

- To understand and develop HDL source code for logic gates.
- To develop HDL source code for combinational and sequential circuits.
- To simulate combinational and sequential circuits.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design and simulate combinational circuits using VHDL.
CO2: Design and simulate sequential circuits using VHDL.
CO3: Analysis of simulation results and schematic diagram of combinational and sequential logic circuits.
CO4: Design simple Digital System (ALU) and implement using VHDL.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	-	-	-	-	3	2	-	3	-	3
CO2	3	2	3	1	-	-	-	-	3	2	-	3	-	3
CO3	3	3	3	1	-	-	-	-	3	2	-	3	-	3
CO4	3	2	3	1	-	-	-	-	3	2	-	3	-	3

Students are required to do the following.

- Target Device Specifications
- Simulation
- Generate RTL Schematic.
- Generate Technology Map.
- Generate Synthesis report.
- Design Summary.

LIST OF EXPERIMENTS:

1. Realization of Logic Gates.
2. Adders and Subtractors.
3. BCD Adder.
4. 3- to - 8Decoder- 74138.
5. 8 x 1 Multiplexer-74151 and 2 x 4 De-multiplexer-74155.
6. 4-Bit Comparator-7485.

7. Flip-Flop-7474.
8. Decade counter-7490.
9. Shift registers-7495.
10. ALU Design.
11. Ones counter.
12. Sequence Detector.

ADDITIONAL EXPERIMENTS:

1. Ripple Counters Realization (Mod –X).
2. Binary to Gray code converter.
3. Design of 4 Bit LFSR.

Note: Use VHDL/ Verilog HDL

EDA Tools/Hardware Required:

1. EDA Tool that supports FPGA Programming including Xilinx / Altera (Intel) / Cypress / Equivalent Industry Standard tool along with corresponding FPGA Hardware.
2. Desktop Computer with appropriate Operating system that supports the EDA tools.

Course Code	ELECTRONIC CIRCUIT ANALYSIS AND DESIGN LAB		L	T	P	C
21A040410			0	0	3	1.5
Pre-requisite	Electronic Devices and Circuits	Semester	IV			

COURSE OBJECTIVES

- Help students make transition from analysis of electronic circuits to design of electronic circuits.
- To understand the Analysis of transistor amplifier at different frequencies.
- To understand the design of transistor oscillators at desired frequencies.
- To understand the Analysis of transistor power amplifier.
- To understand the concept of designing of tuned amplifier.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the single and multistage amplifiers at low, mid and high frequencies using simulation software and Hardware.
CO2: Analyze the transistor oscillators using simulation software and Hardware.
CO3: Determine the efficiencies of power amplifiers using simulation software.
CO4: Analyze Frequency response of tuned amplifiers using hardware and Multisim software.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	3	2	-	3	1	3
CO2	3	3	3	2	-	-	-	-	3	2	-	3	1	3
CO3	3	3	3	2	-	-	-	-	3	2	-	3	1	3
CO4	3	3	3	2	-	-	-	-	3	2	-	3	1	3

LIST OF EXPERIMENTS:

1. CE Amplifier.
2. Two Stage RC Coupled Amplifier
3. Darlington Pair Amplifier
4. Voltage-Series Feedback Amplifier
5. Current-Shunt Feedback Amplifier
6. RC Phase Shift Oscillator
7. Hartley Oscillator
8. Bootstrapped Emitter Follower
9. Class A Series-fed Power Amplifier
10. Class B Push-Pull Power Amplifier
11. Complementary Symmetry Class B Push-Pull Power Amplifier
12. Single Tuned Voltage Amplifier.

Note: Minimum of Ten Experiments must be performed

ADDITIONAL EXPERIMENTS:

1. Colpitt's Oscillator
2. Wien Bridge Oscillator

Note: The students are required to design the electronic circuit and they have to perform the analysis through simulator using Multisim/Pspice/Equivalent Licensed simulation software tool. Further they are required to verify the result using necessary hardware in the hardware laboratory.

Course Code	ANALOG COMMUNICATIONS LAB		L	T	P	C
21A040411			0	0	3	1.5
Pre-requisite	Signals and Systems, Electronic Devices and Circuits	Semester	IV			

COURSE OBJECTIVES:

- To familiarize the students with basic analog communication systems. Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course.
- Understand all types of analog modulation/demodulation principles.
- Substantiate pulse modulation techniques.
- To design and implement different modulation and demodulation techniques.
- To write and execute programs in MATLAB to implement various modulation techniques.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze different analog modulation techniques.
CO2: Design and implement different modulation and demodulation techniques.
CO3: Observe the performance of system by plotting graphs & Measure radio receiver characteristics.
CO4: Simulate all digital modulation and demodulation techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	2	2	-	2	3	-
CO2	3	2	3	2	-	-	-	-	2	2	-	2	3	-
CO3	3	3	3	2	-	-	-	-	2	2	-	2	3	-
CO4	3	2	3	2	-	-	-	-	2	2	-	2	3	-

LIST OF EXPERIMENTS:

1. (a) Develop an Amplitude modulation circuit to get modulated signal for various modulation indices. Verify the Spectrum of the modulated signal experimentally and find its Bandwidth.
   (b) Design a suitable demodulator circuit to recover original information signal.
2. Generate a DSB - SC signal using suitable circuit diagram. Extract information bearing signal from DSB-SC signal. Calculate the power of the DSB-SC signal.
3. (a) Develop a Frequency modulation circuit to get modulated signal for various modulation depths. Verify the Spectrum of the modulated signal experimentally and find its Bandwidth.
   (b) Design a suitable demodulator circuit to recover original information signal.
4. (a) Design a Mixer circuit to verify the principle of operation of Mixer experimentally.

(b) Design a Pre-emphasis & de-emphasis circuit and verify its importance experimentally and plot necessary graph.

5. Construct Pulse Amplitude Modulation circuit and plot modulated signal. Extract the modulated signal by constructing suitable demodulator circuit.
6. Construct Pulse Width Modulation circuit and plot modulated signal. Extract the modulated signal by constructing suitable demodulator circuit.
7. Construct Pulse Position modulation circuit and plot modulated signal. Extract the modulated signal by constructing suitable demodulator circuit.
8. Radio receiver measurements–Sensitivity Selectivity and Fidelity.
9. Simulate AM and FM signals and find power spectrum of each signal. Plot the graphs.
10. Simulate PAM and PWM signals and find power spectrum of each signal. Plot the graphs.
11. Generate a complex Gaussian noise (with zero mean unit variance). And pass through an LTI system. Find the power spectrum density of the noise signal available at the output of LTI system.
12. Make use of AM signal from experiment no. 9 add Gaussian noise (with zero mean and unity variance) to the signal. Extract the information bearing signal using suitable system.
13. Simulate Huffman coding.

EQUIPMENT & SOFTWARE REQUIRED:

Software:

1. Simulations software (MATLAB)

Equipment:

1. Regulated Power Supply (0-30) V
2. CROs (0-20) MHz
3. Function Generators (0-3) MHz
4. RF Signal Generators (0-1000) MHz
5. Multimeters
6. Required Electronic components (active and passive) for the design of experiments.
7. Radio Receiver Demo kits or Trainers.
8. RF power meter frequency range 0–1000MHz
9. Spectrum Analyzer

Note: Conduct experiments (9-12) using MATLAB software. Student has to perform minimum twelve Experiments

Course Code	PCB DESIGN		L	T	P	C
21A040701			1	0	2	2
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To understand the concepts of single and multilayer Printed Circuit Board (PCB) design
- To make students capable to design their own projects PCB up to industrial grade

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the basics of PCB designing.

CO2: Make a Schematic of academic and industrial projects

CO3: Apply advance techniques, skills, and modern tools for designing and fabrication of PCBs.

CO4: Design the PCB for basic and analog electronic circuits.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	3	2	-	2	-	3
CO2	3	2	2	-	-	-	-	-	3	2	-	2	-	3
CO3	3	2	2	-	3	-	-	-	3	2	-	2	-	3
CO4	3	3	2	-	-	-	-	-	3	2	-	2	-	3

TOPICS TO BE COVERED:

Introduction to PCB designing concepts: Introduction to PCB design, Difference between PWB and PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials

Introduction to Electronic design Automation (EDA): Brief History of EDA, Latest Trends in Market, Different EDA tools, Introduction to SPICE and PSPICE Environment, Introduction and Working of PROTEUS

Component introduction and their categories: Types of Components, Active Components (Diode Transistor, MOSFET, LED, SCR, Integrated Circuits), Passive Components (Resistor, Capacitor, Inductor, Transformer, Speaker/Buzzer), Component Package Types

Introduction to Development Tools: Introduction to PCB Design using OrCAD tool, Introduction to PCB Design using PROTEUS tool

Detailed description and practical of PCB designing: PCB Designing Flow Chart, Schematic Entry, Net listing, PCB Layout Designing, Prototype Designing, PCB Making –Printing, Etching, Drilling, Assembly of components

Description of PCB Layers: Electrical Layers: Top Layer, Mid Layer, Bottom Layer, Mechanical Layers- Board Outlines and Cutouts, Drill Details, Documentation Layers - Components Outlines, Reference Designation, Text

Keywords & Their Description: Footprint, Pad stacks, Vias, Tracks, Color of Layers, PCB Track Size Calculation Formula, Rules for Track

LABORATORY EXPERIMENTS:

1. Understanding the schematic Entry, Creating Library & Components
2. Drawing a Schematic, Flat Design / hierarchical Design
3. Setting up Environment for PCB and Design a Board
4. Auto routing -Setting up Rules, Defining Constraints, Auto router Setup
5. PCB Designing of Basic and Analog Electronic Circuits
6. PCB Designing of Power Supplies
7. PCB Designing of Different Sensor modules
8. PCB Designing of Electronics Projects
9. Post Designing & PCB Fabrication Process - Printing the Design, Etching, Drilling,
10. Interconnecting and Packaging electronic Circuits (IPC) Standards
11. Gerber Generation
12. Soldering and De-soldering
13. Component Mounting
14. PCB and Hardware Testing

Project work:

- Making the schematic of Academic and Industrial projects
- PCB Designing of these projects
- Soldering and De-soldering of components as per Design
- Testing and Troubleshooting

Course Code	ELECTROMAGNETIC WAVES AND TRANSMISSION LINES		L	T	P	C
21A040412			3	0	0	3
Pre-requisite	Differential Equations & Vector Calculus	Semester	V			

COURSE OBJECTIVES:

- To introduce fundamentals of static and time varying electromagnetic fields.
- To teach problem solving in Electromagnetic fields using vector calculus.
- To demonstrate wave concept with the help of Maxwell's equations.
- To introduce concepts of polarization and fundamental theory of electromagnetic waves in transmission lines and their practical applications.
- To analyze reflection and refraction of electromagnetic waves propagated in normal and oblique incidences.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the basics of vector analysis, coordinate systems and electrostatic fields. **(K3)**
CO2: Solve the problems of magnetostatics. **(K3)**
CO3: Analyze the boundary conditions of electromagnetic fields at the interface of different media using Maxwell's equations **(K4)**
CO4: Analyze electromagnetic wave propagation in different media. **(K4)**
CO5: Explain the concept of transmission lines and their applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Electrostatics: Review of Vector algebra, Co-ordinate systems, Vector calculus, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic laws of static electric fields. (L2)
- Derive the Maxwell's equations for electrostatic fields. (L3)
- Solve problems applying laws of electrostatics. (L3)

- Apply the laws of electrostatics. (L3)

<u>**UNIT – II**</u> **(8 Hrs)**

Magnetostatics: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic laws of static magnetic fields. (L2)
- Derive the Maxwell's equations for magnetic fields. (L3)
- Solve problems applying laws of magneto statics. (L3)
- Apply the laws of magnetostatics. (L3)

<u>**UNIT – III**</u> **(8 Hrs)**

Maxwell's Equations (for Time Varying Fields): Faraday's Law and Transformer e.m.f., Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic of Maxwell's Equations. (L2)
- Derive the Maxwell's equations for electromagnetic fields. (L3)
- Analyze the boundary conditions of electromagnetic fields at the interface of different media. (L4)

<u>**UNIT – IV**</u> **(10 Hrs)**

EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, Relation between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Theorem – Applications, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of EM wave characteristics. (L2)
- Understand the concept of power flow using Poynting theorem. (L2)
- Derive wave equations for different media. (L3)
- Analyze the concept of wave propagation through the Maxwell's equations. (L4)
- Analyze concept of polarization of electromagnetic wave. (L4)

UNIT – V (9 Hrs)

Transmission Lines: Types, Transmission line parameters (Primary and Secondary), Transmission line equations, Input impedance, Standing wave ratio & power, Smith chart & its applications, Applications of transmission lines of various lengths, Microstrip transmission lines, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principles of transmission lines and concept of smith chart (L2)
- Derive the input impedance of transmission line (L3)
- Solve the transmission line parameters (L3)
- Analyze the transmission lines of different lengths (L4)

TEXTBOOKS:

1. “Elements of Electromagnetics”, Matthew N.O. Sadiku, Oxford Univ. Press, 4th Edition, 2008.
2. “Engineering Electromagnetics”, William H. Hayt Jr. and John A. Buck, TMH, 7th Edition, 2006.

REFERENCE BOOKS:

1. “Electromagnetic Waves and Radiating Systems”, E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.
2. “Electromagnetics”, John D. Krauss, McGraw- Hill publication, 4th Edition, 1999.
3. “Electromagnetics”, Schaum’s outline series, Tata McGraw-Hill publications, 2nd Edition, 2006.

ONLINE LEARNING RESOURCES:

1. https://www.onlinecourses.nptel.ac.in/noc21_ee53/preview
2. https://www.nptel.ac.in/courses/108106152

Course Code	INTEGRATED CIRCUITS AND APPLICATIONS		L	T	P	C
21A040413			3	0	0	3
Pre-requisite	Pulse and Digital Circuits	Semester	V			

COURSE OBJECTIVES:

- To understand DC and AC characteristics of operational amplifiers & Op amp parameters and functionality of specialized ICs such as 555 TIMER, VCO, PLL & Voltage regulators.
- To design circuits for various applications using Op-Amps and specialized ICs.
- To analyze Op-Amp based Comparators, Waveform generators, Active filters, Converters.
- To design of Op-Amp based Comparators, Waveform Generators, Active filters, Converters, design various multi-vibrator circuits using IC 555 timer.
- To analyze different types of A/D and D/A Converter circuits.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the construction and characteristics of ideal and practical operational amplifiers. **(K3)**
CO2: Analyze linear applications using Op-Amp. **(K4)**
CO3: Analyze Op-Amp based non-linear applications and waveform generators. **(K4)**
CO4: Compare data converter (ADC and DAC) Circuits using Op-Amps. **(K5)**
CO5: Construct different applications of special purpose IC's such as 555 Timer, 566 VCO, 565 PLL **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3	3	3

UNIT – I (11 Hrs)

Operational Amplifier: Introduction, Block diagram, Characteristics and Equivalent circuits of an ideal Op-Amp, Various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, Inverting and non-inverting amplifier configurations. The Practical Op-Amp: Introduction, Input offset voltage, Offset current, Thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and Gain – bandwidth product, frequency limitations and compensations, transient response.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the construction and working of Op-Amp. (L2)
- Compare Op-Amp open loop and closed loop configurations. (L2)
- Identify different offsets present in Op-Amp and provide nullification. (L2)
- Compare ideal and practical Op-Amps characteristics. (L3)

UNIT – II (10 Hrs)

Applications of Operational Amplifier: Amplifiers: Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier, Converters: Current to voltage and voltage to current converters, Active Filters: First order filters, second order active finite and infinite gain low pass, high pass, band pass and band reject filters.

Learning Outcomes: At the end of this unit, students should be able to

- Describe operation of Op-Amp based Linear application circuits, converters, amplifiers. (L2)
- Design circuits such as amplifiers, comparator, differentiators and integrators using operational amplifiers for various applications. (L3)
- Design active filters using Op amp for given specifications. (L3)

UNIT – III (8 Hrs)

Non-Linear Applications of Operational Amplifier: Comparators: Inverting comparator, non-inverting comparator, zero crossing detector, window detector and level detector, Schmitt Triggers: Inverting Schmitt trigger, non-inverting Schmitt trigger with adjustable threshold levels. Precision Rectifiers: Half and full wave precision, rectifiers, log and antilog amplifiers, voltage to frequency converter, frequency to voltage converter.

Waveform Generators: Sine Wave Oscillators: RC phase shift oscillator, Wien bridge oscillator, Square wave and triangular wave generator with duty cycle modulation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe operation of Op-Amp based comparators, converters, detectors, rectifiers and waveform generators. (L2)
- Analyse Op-Amp based Comparators, converters, detectors, rectifiers and waveform generators. (L4)
- Design Waveform generators, voltage to frequency converters & frequency to voltage converters for given specification. (L3)

UNIT – IV (7 Hrs)

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC. Dual Slope ADC, DAC and ADC Specifications.

Learning Outcomes: At the end of this unit, students should be able to

- Compare different types of A/D & D/A converter circuits. (L5)
- Explain operating principles of different A/D & D/A converters. (L3)
- Examine ADC & DAC specifications to select the right converter for an application. (L3)

UNIT – V (9 Hrs)

Special Purpose Integrated Circuits: Functional block diagram, working, design and applications of Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO 566, PLL 565, Fixed and variable Voltage regulators.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the operation of 555 timer, IC voltage regulators. (L2)
- Describe functionality of special purpose ICs such as VCO, PLL. (L2)
- Construct multi-vibrator circuits using timer. (L3)

TEXTBOOKS:

1. "Op-Amps & Linear ICs", Ramakanth A. Gayakwad, 4th Edition, Pearson, 2017.
2. "Linear Integrated Circuits", D. Roy Choudhury, 2nd Edition, New Age International (p) Ltd, 2003.

REFERENCE BOOKS:

1. "Integrated Electronics - Analog and Digital circuits system", Jacob Millman, Christos C. Halkias, Tata McGraw Hill, 2003.
2. "Design with Operational Amplifiers & Analog Integrated Circuits", Sergio Franco, 3rd Edition, McGraw Hill, 1988.
3. "Analysis and Design of Analog Integrated Circuits", Gray and Meyer, 5th Edition, Wiley International, 2009.

Course Code	DIGITAL COMMUNICATIONS		L	T	P	C
21A040414			3	0	0	3
Pre-requisite	Probability Theory and Stochastic Processes, Signals & Systems, Analog Communications	Semester	V			

COURSE OBJECTIVES:

- To understand the key modules of digital communication systems with emphasis on digital modulation techniques.
- To get introduced to the concept and basics of information theory and the basics of source and channel coding/decoding.
- To prepare mathematical background for communication signal analysis.
- To study signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze different pulse modulation techniques & Distortions in communication systems. **(K4)**

CO2: Analyze the basic principles of baseband modulation schemes. **(K4)**

CO3: Analyze the different modulation & demodulation for pass band data transmission and their probability of error. **(K4)**

CO4: Compare the power bandwidth, bit error probability for various modulation schemes. **(K4)**

CO5: Apply different channel encoding techniques for error detection and correction. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	2	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (10 Hrs)

Source Coding Systems: Introduction, sampling process, quantization, quantization noise, conditions for optimality of quantizer, encoding, Pulse-Code Modulation (PCM), Line codes, Differential encoding, Regeneration, Decoding & Filtering, Noise considerations in PCM systems, Time-Division Multiplexing (TDM), Synchronization, Delta modulation (DM)-Granular noise Slope over distortion, Differential PCM (DPCM), Processing gain, Adaptive DPCM (ADPCM), Comparison of the above systems, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss source coding techniques & pulse modulation techniques. (L2)

- Describe and determine the performance of line codes. (L2)
- Analyze different pulse modulation techniques & Distortions. (L4)
- Compare the performance of different pulse modulation Schemes. (L4)

UNIT – II (9 Hrs)
Baseband Pulse Transmission: Introduction, Matched filter, Properties of Matched filter, Matched filter for rectangular pulse, Error rate due to noise, Inter-symbol Interference (ISI), Nyquist's criterion for distortion less baseband binary transmission, ideal Nyquist channel, raised cosine filter & its spectrum, Correlative coding – Duo binary & Modified duo binary signaling schemes, Partial response signaling, Baseband M-ary PAM transmission, Eye diagrams, Illustrative Problems.
Learning Outcomes: At the end of this unit, students should be able to

- Analyze the performance of baseband pulse transmission system. (L4)
- Describe the generation & detection of baseband modulated signals. (L2).
- Analyze probability of error for various baseband data transmission schemes. (L4)

UNIT – III (8 Hrs)
Signal Space Analysis: Introduction, Geometric representation of signals, Gram-Schmidt orthogonalization procedure, Response of bank of correlators to noisy input, Coherent detection of signals in noise - maximum likelihood decoder, Probability of error, Correlation receiver, detection of signals with unknown phase, Illustrative Problems.
Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of signal space analysis. (L2)
- Examine the characteristics of maximum likelihood decoder. (L3)
- Analyze correlation receiver. (L4)

UNIT – IV (9 Hrs)
Passband Data Transmission: Introduction, Passband transmission model, Coherent modulation schemes- Generation and detection of binary phase shift keying (BPSK), Quadrature shift keying (QPSK), and Binary Frequency shift keying (BFSK). Analysis of probability of error for BPSK, QPSK, BFSK, Power spectra of above-mentioned modulated signals. M-ary PSK, Mary quadrature amplitude modulation (M-ary QAM), Non-coherent orthogonal modulation schemes - Generation and detection of non-coherent BFSK, DPSK - analysis of probability of error and Comparison of power bandwidth requirements for all the above schemes, Illustrative Problems.
Learning Outcomes: At the end of this unit, students should be able to

- Analyse the different digital modulation techniques, generation and detection, power spectra and their probability of error performance. (L4)
- Compare the power bandwidth, bit error probability for various modulation scheme. (L4)

UNIT – V (9 Hrs)
Channel Coding: Discrete memory less channels, Linear Block Codes-Repetition codes, Syndrome decoding, minimum distance considerations, Cyclic codes- generator polynomial, parity check polynomial, encoder for cyclic code, calculation of syndrome, Convolutional Codes – generator polynomials, state diagrams, Viterbi algorithm, Illustrative problems.
Learning Outcomes: At the end of this unit, students should be able to

- Understand various error control encoding and decoding techniques. (L2)
- Apply information theory and linear algebra in source coding and channel coding. (L3)
- Analyse the performance of error control codes. (L4)

TEXTBOOKS:

1. "Communication Systems", Simon Haykin, Wiley India Edition, 4th Edition, 2011.
2. "Modern Digital & Analog Communication Systems", B.P. Lathi, & Zhi Ding, 4th Edition, Oxford University Press, International 2010.

REFERENCE BOOKS:

1. "Digital and Analog Communication Systems", Sam Shanmugam, 3rd Edition, John Wiley, 2005.
2. "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", Bruce Carlson and Paul B. Crilly, 5th Edition, McGraw Hill International, 2010
3. "Microwave and Radar Engineering", M. Kulkarni, Umesh Publications, 4th Edition, 2009.
4. "Digital Communications", Bernard Sklar, 2nd edition, Prentice-Hall PTR, 2001.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117101051
2. https://www.sciencedirect.com/topics/engineering/digital-communication-system
3. https://www.mastersportal.com/disciplines/322/digital-communication.html

Course Code	DATA COMMUNICATION AND NETWORKING		L	T	P	C
21A040415			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To provide a solid conceptual understanding about the data communication fundamentals and computer networking.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the layers in ISO/OSI model and switching techniques in networks. **(K3)**
CO2: Analyze the functions of various Data link layer protocols. **(K4)**
CO3: Compare the various IEEE standards for LANs and WLAN **(K4)**
CO4: Explain the functions of various routing algorithms and IPvx protocols. **(K4)**
CO5: Analyze the functions of transport layer protocols and application layer protocols. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-

UNIT – I (9 Hrs)

Data Communications: Components, protocols and standards, Network and Protocol Architecture, Internet, Reference Model ISO-OSI, TCP/IP-Overview, topology, transmission modes, digital signals, digital data transmission, transmission impairment, Data rate limits, Performance, wavelength and Shannon capacity, digital to digital encoding, transmission media: guided and unguided, Modems, cable modem

Switching: Circuit switching (space-division, time division and space-time division), packet switching (virtual circuit and Datagram approach), message switching.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the fundamentals of data communication systems and transmission media. (L2)
- Explain the layers in ISO-OSI Model and TCP/IP. (L3)
- Illustrate the various switching techniques in networks (L3)

UNIT – II (10 Hrs)

Data Link Layer: Review of Error Detection and Correction codes, Design issues, Data Link Control and Protocols: Flow and Error Control, Stop-and wait ARQ. Sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point-to – Point Access: Point –to- Point Protocol

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the functions of various Data link layer protocols. (L4)
- Explain the functions of HDLC and Point to Point protocols (L3).

UNIT – III (8 Hrs)

Multiple Access: Channel allocation problem, Controlled Access, Channelization, multiple access protocols, IEEE standard 802.3 & 802.11 for LANs and WLAN, Token ring, Token Bus, FDDI based LAN, Network Devices - repeaters, hubs, switches, bridges.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the multiple access techniques for various networks (L3)
- Compare the various IEEE standards for LANs and WLAN (L4)
- Understand the role of connecting devices in networks (L2)

UNIT – IV (9 Hrs)

Network Layer: Design issues, Unicast Routing algorithms, Host to Host Delivery: Internetworking, IP addressing (Classfull & Classless), Subnet, Network Layer Protocols: ARP, IPV4, ICMP, IPV6.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various routing algorithms (L3).
- Understand the concepts of network layer protocols (L2).
- Apply the IP addresses to systems in any network (L3).

UNIT – V (9 Hrs)

Transport Layer: Process to Process Delivery: UDP; TCP, congestion control and Quality of service.

Application Layer: Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP), file transfer (FTP), HTTP and WWW

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of process to process delivery, congestion control and QOS (L2).
- Distinguish between the connection oriented and connection less transport protocols (L4).
- Analyze the functions of Application layer protocols (L4).

TEXTBOOKS:

1. "Data Communications and Networking", Behrouz A. Forouzan, Tata McGraw-Hill, 4th Edition
2. "Computer Networks", S. Tannenbum, D. Wetherall, Prentice Hall, Pearson, 5th Edition

REFERENCE BOOKS:

1. "Computer Networks", Fred Halsall, Addison - Wesley Publication. Co., 1996.
2. "Computer Networks: A system Approach", Larry L, Peterson and Bruce S. Davie, Elsevier, 4th Edition.
3. "Introduction to Data Communications & Networking", Wayne Tomasi, Pearson Education, 7th Edition, 2011
4. "Data and Computer Communications", William Stallings, Prentice Hall, Imprint of Pearson, 9th Edition.

ONLINE LEARNING RESOURCES:

1. https://ocw.mit.edu/courses/6-263j-data-communication-networks-fall-2002/
2. https://www.ibm.com/topics/networking
3. https://skillsforall.com/course/networking-basics?utm_medium=referral&utm_source=cisco.com&utm_campaign=writ&utm_content=networking-basics_coursepage&utm_team=field_global

Course Code	ELECTRONIC MEASUREMENTS & INSTRUMENTATION		L	T	P	C
21A040416			3	0	0	3
Pre-requisite	Electronic Devices and Circuits	Semester	V			

COURSE OBJECTIVES:

- To provide an understanding of various measuring systems functioning and metrics for performance analysis.
- To provide an understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analysers, recorders and measuring equipment.
- To provide an understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the knowledge of DC and AC meters while solving problems related to measurement errors. **(K4)**

CO2: Analyze the performance of various CROs. **(K4)**

CO3: Analyze the performance various signal generators and analysers. **(K4)**

CO4: Compare different types of bridge circuits. **(K4)**

CO5: Measure various physical parameters by appropriately selecting the transducers. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Performance characteristics of Instruments: Static characteristics, Accuracy, Precision, Resolution, Sensitivity, static and dynamic calibration, Errors in Measurement, and their statistical analysis, dynamic characteristics-speed of Response, fidelity, Lag and dynamic error. DC ammeters, DC voltmeters, AC voltmeters Thermocouple type RF ammeter, ohmmeters -series type, shunt type, Multimeter for voltage, current and resistance measurements, illustrative problems.

Learning Outcomes: At the end of this unit, students should be able to

- Remember different terms used for characterizing the performance of an instrument / measurement system (L1)
- Understand the principle of operation of various meters (L2)
- Apply the knowledge of DC and AC meters while solving problems related to measurement errors (L3)

UNIT – II (9 Hrs)

Oscilloscopes: Standard specifications of CRO, CRT features, vertical and horizontal amplifiers, horizontal and vertical deflection systems, sweep trigger pulse, delay line, sync selector circuits, probes for CRO – active, passive and attenuator type, dual trace/beam CRO, Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time & Period measurements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic principles of CROs (L2)
- Analyze the performance of various CROs (L4)

UNIT – III (8 Hrs)

Signal Generators and Analyzers: Fixed and variable frequency AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach); Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic principle of various signal generators and analyzers (L1)
- Describe characteristics of signal generators and analyzers (L2)
- Distinguish principles of working of wave analyzer and spectrum analyzer (L4)

UNIT – IV (8 Hrs)

Bridges: Wheatstone bridge, Wein Bridge, errors and precautions in using bridges, AC bridges: Measurement of inductance-Maxwell's bridge, Anderson Bridge. Measurement of capacitance-Schearing Bridge, Kelvin Bridge, Q-meter, EMI and EMC, Interference and noise reduction techniques.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic principle of various bridges (L2)
- Compare different types of bridge circuits (L4)

UNIT – V (10 Hrs)

Sensors and Transducers: Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples, and thermistors), Velocity, Acceleration, Vibration, pH measurement.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic principle of sensors and transducers (L1)
- Explain working principle of various transducers and sensors (L2)
- Select the appropriate sensor/transducer for the measurement of physical parameters (L5)

TEXTBOOKS:

1. "Modern Electronic Instrumentation and Measurement Techniques", D. Helfrick, W.D. Cooper, 2nd Edition, Pearson Education India, 2015.
2. "Electronic Instrumentation", H. S. Kalsi, 3rd Edition, McGraw Hill Education, 2017.

REFERENCE BOOKS:

1. "Electronic Instrumentation and Measurements", David A. Bell, Oxford University Press, 2007.
2. "Electronic Measurements and Instrumentation", B.M. Oliver, J.M. Cage, TMH Reprint 2009.
3. "Measurement Systems", Ernest O. Doebelin and Dhanesh N Manik, 6th Edition, TMH, 2010.

ONLINE LEARNING RESOURCES:

1. https://en.wikipedia.org/wiki/PH_meter

Course Code	CONCEPTS OF MACHINE LEARNING		L	T	P	C
21A040417			3	0	0	3
Pre-requisite	Probability Theory & Stochastic Processes	Semester	V			

COURSE OBJECTIVES:

- Gain knowledge about basic concepts of Machine learning
- Understand various key paradigms for machine learning approaches
- Understand a range of machine learning algorithms along with their strengths and weaknesses.
- Understand different computational learning theory.
- Differentiate among various machine learning techniques.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Understand and Identify machine learning techniques suitable for a given problem **(K2)**
CO2: Analyze and compare the various learning algorithms **(K4)**
CO3: Solve the problems using various machine learning techniques **(K3)**
CO4: Analyze the concept of neural networks for learning linear and non-linear activation functions **(K4)**
CO5: Understand the concepts in Bayesian analysis from probability models and methods **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	2	-	2	-	-	-	-	-	-	-	3	2	-
CO3	3	3	-	2	-	-	-	-	-	-	-	3	2	-
CO4	3	3	-	2	-	-	-	-	-	-	-	3	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction: Learning Problems – Perspectives and Issues – Concept Learning, Goals and applications of machine learning, Aspects of developing a learning system: training data, concept representation, function approximation.

Inductive Classification: The concept learning task, Concept learning as search through a hypothesis space, General-to-specific ordering of hypotheses, Finding maximally specific hypotheses, Version spaces and the candidate elimination algorithm, Learning conjunctive concepts, The importance of inductive bias.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various key paradigms for machine learning approaches (L2)
- Learn the basics of learning problems with hypothesis and version spaces (L1)

UNIT – II (9 Hrs)

Decision Tree Learning: Representing concepts as decision trees, Issues in Decision tree learning, Recursive induction of decision trees, picking the best splitting attribute: entropy and information gain, searching for simple trees and computational complexity, Occam's razor, Over fitting, noisy data, and pruning.

Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Decision tree learning and their issues. (L2)
- Understand the basic theory underlying machine learning (L2).

UNIT – III (9 Hrs)

Computational Learning Theory: Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity for infinite hypothesis spaces, Vapnik – Chervonenkis dimension.

Rule Learning: Propositional and First-Order, Translating decision trees into rules, Heuristic rule induction using separate and conquer and information gain, First-order Horn-clause induction (Inductive Logic Programming) and Foil, Learning recursive rules, Inverse resolution, Golem, and Progol

Learning Outcomes: At the end of this unit, students should be able to

- Explain a very broad collection of computational learning algorithms and problems (L3)
- Develop an appreciation for what is involved in learning from data. (L4)

UNIT – IV (9 Hrs)

Artificial Neural Networks: Neurons and biological motivation, Linear threshold units. Perceptrons, representational limitation and gradient descent training, Multilayer networks and back propagation, Hidden layers and constructing intermediate, distributed representations. Over fitting, learning network structure, recurrent networks.

Support Vector Machines: Maximum margin linear separators. Quadratic programming solution to finding maximum margin separators, Kernels for learning non-linear functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Neural Networks and its usage in machine learning application. (L2).
- Characterize the machine learning algorithms as supervised learning and unsupervised learning, apply and analyze the various algorithms of supervised and unsupervised learning (L3).

UNIT – V (9 Hrs)

Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm, Parameter smoothing, Generative vs. discriminative training, Logistic regression, Bayes nets and Markov nets for representing dependencies.

Instance-Based Learning: Constructing explicit generalizations versus comparing to past specific examples. K-Nearest-neighbor algorithm, Case-based learning.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the features of machine learning to apply on real world problems (L2).
- Design application using machine learning techniques (L3).

TEXTBOOKS:

1. "Machine Learning", T.M. Mitchell, McGraw-Hill, 1997.
2. "Machine Learning", Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

REFERENCE BOOKS:

1. "Introduction to Machine Learning", Ethern Alpaydin, MIT Press, 2004.
2. "Machine Learning -An Algorithmic Perspective", Stephen Marsland, 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014
3. "Introduction to Machine Learning with Python: A Guide for Data Scientists", Andreas C. Müller and Sarah Guido, Oreilly
4. "Pattern Recognition and Machine Learning", Christopher Bishop

ONLINE LEARNING RESOURCES:

1. https://www.deeplearning.ai/machine-learning-yearning/
2. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html
3. http://nptel.ac.in/courses/106106139/

Course Code	INTEGRATED CIRCUITS AND APPLICATIONS LAB		L	T	P	C
21A040418			0	0	3	1.5
Pre-requisite	Pulse and Digital Circuits	Semester	V			

COURSE OBJECTIVES:

- To understand the working of Op amp ICs & Application specific analog ICs.
- To design Operational amplifiers for linear and nonlinear application, Multivibrator circuits using 555 & application specific ICs.
- To simulate linear and nonlinear application-based Op amp Circuits and circuits based on application specific ICs.
- To compare theoretical, practical & simulated results in integrated circuits.
- To analyze operational amplifier based circuits for linear and non-linear applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design and test the performance of Operational amplifier applications. **(K5)**

CO2: Construct and study comparator, Schmitt trigger, Signal converters, rectifiers, Logarithmic amplifier and Instrumentation amplifier, R-2R DAC using Op-Amp. **(K3)**

CO3: Design and test the performance of 2nd and 3rd order active filters. **(K5)**

CO4: Design and verify the operation of astable and monostable circuits using 555 timer. **(K5)**

CO5: Test the functionality of different ICs 565, 78XX/79XX and LM723. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	3	3	-	3	3	3
CO2	3	2	2	2	-	-	-	-	3	3	-	2	3	3
CO3	3	3	3	2	-	-	-	-	3	3	-	3	3	3
CO4	3	3	3	2	-	-	-	-	3	3	-	3	3	3
CO5	3	3	3	2	-	-	-	-	3	3	-	3	3	3

LIST OF EXPERIMENTS:

1. Applications of Op-Amp
   Design and test the performance of the following circuits using Op-Amp IC741/TL082
   a. Inverting amplifier
   b. Non-inverting amplifier
   c. Voltage follower
   d. Summer
2. Design and test the performance of practical differentiator and integrator circuits for various time constants. Plot the graphs.

3. Comparator circuits
   Construct comparator with variable reference voltages and Schmitt trigger using Op-Amp.
4. Signal converters
   Construct suitable circuits for Voltage to Current and Current to Voltage converters using Op-Amp.
5. Active filters using Op-Amp
   Design and test the performance of 2nd and 3rd order Butterworth LPF and HPF.
6. Active filters using Op-Amp
   Design and test the performance of 2nd order Butterworth BPF and BSF.
7. Construct and verify the performance of
   a. Logarithmic and antilog amplifiers b. Instrumentation amplifier
8. Precision rectifiers
   Conduct experiments on half wave and full wave precision rectifiers and draw the output waveforms.
9. Design the monostable multivibrator circuit and verify their performance practically using IC 555.
10. Design the astable multivibrator circuit and verify their performance practically using IC 555.
11. Data converters
    Construct and study performance of
    a. DAC circuits – R-2R and ladder type.
    b. Successive approximation type ADC.
12. Test the performance of PLL IC565.
13. Design a DC power supply using 78XX/79XX andLM723, verify the same practically.

SOFTWARE REQUIRED:

1. Multisim/ Pspice/Equivalent simulation software tool

Note:

1. At least 12 experiments from the above list shall be performed. Out of them any 4 experiments should be conducted using software tools.
2. All the Hardware experiments may be performed using ICs 741, TL082, 555,565

Course Code	DIGITAL COMMUNICATIONS LAB		L	T	P	C
21A040419			0	0	3	1.5
Pre-requisite	Signals & Systems, Analog Communications	Semester	V			

COURSE OBJECTIVES:

- To develop skills for performance analysis of practical digital communication systems.
- To understand the fundamental concepts on TDM, Pulse modulation & digital modulation techniques.
- To evaluate the performance of PCM, DPCM and DM in a digital communication system.
- To learn how to use MATLAB software and hardware effectively and creatively to synthesis digital communication systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain real time behavior of different digital modulation schemes and technically visualize spectra of different digital modulation schemes. **(K3)**

CO2: Analyze digital modulation & demodulation techniques. **(K4)**

CO3: Design and implement different modulation and demodulation techniques. **(K4)**

CO4: Simulate digital modulation and demodulation techniques in MATLAB. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	3	3	-	3	3	-
CO2	3	3	2	2	-	-	-	-	3	3	-	3	3	-
CO3	3	3	2	2	-	-	-	-	3	3	-	3	3	-
CO4	3	3	2	2	-	-	-	-	3	3	-	3	3	-

LIST OF EXPERIMENTS:

HARDWARE EXPERIMENTS (PART – A)

1. Study and verify the sampling theorem.
2. Verify Time division multiplexing circuit to multiplex three users' data.
3. Verify the functionality of each block in Pulse code modulation system practically.
4. Verify the functionality of each block in a Differential pulse code modulation circuit experimentally.
5. Verify the operation of Delta modulation and demodulation.
6. Verify modulated and demodulated circuit for Frequency shift keying.
7. Verify a modulated and demodulated circuit for Differential phase shift keying.

SOFTWARE EXPERIMENTS (PART-B)

1. Study Sampling Theorem and verify the effect of under sampling and oversampling while retrieving the original signal.
2. Understand functioning of each block in Pulse code modulation circuit and verify through simulation.
3. Write a program on Differential pulse code modulation and demodulation.
4. Write a program on Frequency shift keying modulation schemes for given two carrier frequencies.
5. Write a program and verify QPSK modulation and demodulation, determine the bit error probability.
6. Write a program and verify Differential phase shift keying modulation scheme is a non-coherent modulation scheme, determine the bit error probability.
7. Design and verify working principle of BPSK modulation and demodulation through simulation.

SOFTWARE REQUIRED:

1. MATLAB / Equivalent Software

Note: Minimum of Twelve experiments are to be conducted (any six from each part)

Course Code	PROGRAMMING ARDUINO		L	T	P	C
21A040702			1	0	2	2
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To acquire knowledge on different Smart System applications using Arduino.
- To familiarize with Arduino boards, IDE, programming language & platform.
- To acquire knowledge on Arduino boards and basic components.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the basics of programming Arduino. **(K3)**
CO2: Design the prototype circuits and connect them to the Arduino. **(K6)**
CO3: Apply the Programming concept of Arduino microcontroller to develop the circuits. **(K3)**
CO4: Develop skills to design and implement various smart system application. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	3	3	-	3	3	3
CO2	3	3	3	3	-	-	-	-	3	3	-	3	3	3
CO3	3	2	2	2	-	-	-	-	3	3	-	3	3	3
CO4	3	2	2	2	-	-	-	-	3	3	-	3	3	3

LIST OF EXPERIMENTS:

Module-1: Arduino:

- Introduction to Arduino
- Pin configuration and architecture.
- Device and platform features.
- Concept of digital and analog ports.
- Familiarizing with Arduino Interfacing Board
- Introduction to Embedded C and Arduino platform
-

Module-2: Arduino Displays

- Working with Serial Monitor
- Line graph via serial monitor
- Interfacing a 8 bit LCD to Arduino
- Fixed one-line static message display.
- Running message display.
- Using the LCD Library of Arduino.

Module-3: Arduino Sensors

- Arduino – Humidity Sensor
- Arduino – Temperature Sensor
- Arduino – Water Detector / Sensor
- Arduino – PIR Sensor
- Arduino – Ultrasonic Sensor
- Arduino – Connecting Switch (Magnetic relay switches)

Case Study-1: Control Light & Fan with Clap using Arduino

Design a IoT application which controls the home appliances like Fan, TV, light and etc using sound effect. This project is very useful for elderly and differently abled persons to control their room with depending one other. Source link: https://www.youtube.com/watch?v=hzUFnP3Xt7c

Case Study -2: Rain Alert System using Arduino

Design a system to alert the people when is raining. This system is very useful for vehicles to switch on the wipers as well as many places where the device working based on rain.
Source link: https://www.youtube.com/watch?v=YlIH1ti4Vy0

Case Study -3: Theft Alert System using Arduino

Design a system to alert the people using IR sensor when the motion is detected. This system is useful for high security areas. Source link: https://www.youtube.com/watch?v=zOmsl-dTq8M

Case Study-4: Water Level Meter using Water Level Sensor

Design a sensor which can sense the water level in tanks where the motor pumps are used. There is no specific method to check the level of the water. Use water level sensor or Ultrasonic sensor to design this system. Source Link: https://www.youtube.com/watch?v=n7WRi5U5lQk

Case Study-5: Arduino Funny Jumper Game

Design a Funny Jumper game using an Arduino Uno and 16 x2 LED display. The main objective of this game is to gain the highest score. This game is an interesting addictive fun game. This is a one button human vs Arduino game uses a push button for jumping. The game ends whenever the player fails to jump when obstacle arrives. Two or more players can play the game in turn-wise and use some strategy to win the game. Source Link: https://youtu.be/flC3_X-yJ-I

TEXTBOOKS:

1. "Programming Arduino: Getting Started with Sketches", Simon Monk, McGraw Hill TAB, 2nd Edition, 2016.
2. "Programming and Interfacing with Arduino", Yogesh Misra, CRC Press, 1st Edition, 2021.

REFERENCE BOOKS:

1. "Getting Started with Arduino", Massimo Banzi, O'Reilly Media, Incorporated, 2^{nd} Edition, 2011.
2. "Internet of Things with Raspberry Pi and Arduino", Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, CRC Press, 2019.

ONLINE LEARNING RESOURCES:

1. https://www.tutorialspoint.com/arduino/index.htm
2. https://create.arduino.cc/projecthub
3. https://create.arduino.cc/projecthub/projects/tags/arduino

Course Code	UNIVERSAL HUMAN VALUES (Common to all branches)		L	T	P	C
21A000003			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the significance and need of values in the society. **(K2)**

CO2: Understand the meaning of Harmony in the Self the Co-existence of Self and Body. **(K2)**

CO3: Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society **(K2)**

CO4: Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. **(K3)**

CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-

UNIT – I (9 Hrs)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the significance and need of values in the society. (L2)

<u>UNIT – II</u> (9 Hrs)

Understanding Harmony in the Human Being - Harmony in Myself: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programs to ensure self-regulation and Health.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the meaning of Harmony in the Self the Co-existence of Self and Body. (L2)
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. (L2)

<u>UNIT – III</u> (9 Hrs)

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order

Learning Outcomes: At the end of this unit, students should be able to

- Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society (L2)

<u>UNIT – IV</u> (9 Hrs)

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at all Levels, and the Holistic Perception of Harmony in Existence.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. (L3)

<u>UNIT – V</u> (9 Hrs)

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Learning Outcomes: At the end of this unit, students should be able to

- Identify the scope and characteristics of people friendly and eco-friendly production systems. (L2)
- Develop appropriate technologies and management patterns for above production systems. (L3)

- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. (L3)

TEXTBOOKS:

1. "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

REFERENCE BOOKS:

1. "Jeevan Vidya: Ek Parichaya", A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. "Human Values", A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. "The Story of My Experiments with Truth", Mohandas Karamchand Gandhi
5. "Small is Beautiful", E. FSchumacher.
6. "Slow is Beautiful", Cecile Andrews
7. "Economy of Permanence", J C Kumarappa
8. "Bharat Mein Angreji Raj", Pandit Sunderlal
9. "Rediscovering India", Dharampal,
10. "Hind Swaraj or Indian Home Rule", Mohandas K. Gandhi,
11. "India Wins Freedom", Maulana Abdul Kalam Azad
12. "Vivekananda", Romain Rolland (English)
13. "Gandhi", Romain Rolland (English)

ONLINE LEARNING RESOURCES:

1. http://www.uhv.org.in/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://www.studocu.com/in/document/dr-apj-abdul-kalam-technical-university/universal-human-valuestechnical-communication/uhv-best-notes/31376289

Course Code	ANTENNAS & MICROWAVE ENGINEERING		L	T	P	C
21A040420			3	0	0	3
Pre-requisite	Electromagnetic Waves and Transmission Lines	Semester	VI			

COURSE OBJECTIVES:

- To enable the student to understand the basic principles in antenna and microwave system design
- To make the student to acquire knowledge in the area of various antenna designs.
- To enhance the student knowledge in the area of microwave components and antenna for practical applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Learn about the basics of antenna parameters & radiation patterns. **(K3)**

CO2: Design and analyse VHF, UHF and Microwave antennas. **(K4)**

CO3: Understand the uses of antenna arrays and analyze waveguides and resonators. **(K4)**

CO4: Analyse various microwave Components and understand the principles of various microwave sources. **(K4)**

CO5: Understand the working of various microwave solid state devices. **(K3)**

MAPPING WITH COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	2	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	-
CO4	3	3	2	1	-	-	-	-	-	-	-	2	2	-
CO5	3	3	2	1	-	-	-	-	-	-	-	2	2	-

UNIT – I (9 Hrs)

Antenna Basics &Wire Antennas: Definition of antenna, Radiation Mechanism – single wire, two wire, dipoles, Antenna Parameters - Radiation Patterns, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Aperture Efficiency, Effective Height and length, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Field Components, Radiated power, Radiation Resistance, Introduction to Loop Antennas, Arrays with Parasitic Elements - Yagi - Uda Arrays, Folded Dipoles & their characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand radiation mechanism and basic antenna characteristics. (L1)
- Compute radiation intensity, gain and directivity of antennas. (L2)

UNIT – II (8 Hrs)

VHF, UHF and Microwave Antennas : Helical Antennas-Helical Geometry, Helix modes, Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design considerations of Pyramidal Horns, Micro strip Antennas- Introduction, features, advantages and limitations, Rectangular patch antennas- Geometry and parameters, characteristics of Micro strip antennas, reflector antennas - Introduction, corner reflectors, parabola reflectors- geometry, pattern characteristics, Feed Methods, Introduction to Lens Antennas

Learning Outcomes: At the end of this unit, students should be able to

- Describe feeding methods for microstrip antennas. (L2)
- Design rectangular and circular patch antenna for given specifications. (L4)

UNIT – III (11 Hrs)

Antenna Arrays and propagation: Arrays of 2 Isotropic sources- Different cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, Binomial Arrays, Different modes of wave propagation, Ground wave propagation, Space wave propagation - Sky wave propagation (Qualitative treatment).

Waveguides: Introduction, Rectangular waveguides, Field expressions for TE and TM modes, Wave propagation in the guide, Phase and group velocities, Circular Waveguide – TE and TM modes (Qualitative Treatment), waveguide resonators.

Learning Outcomes: At the end of this unit, students should be able to

- Derive expressions for radiation resistance, directivity of wire antenna, (L3)
- Obtain radiation pattern of various array antennas using pattern multiplication. (L3)
- To know the design aspects of antenna arrays. (L4)
- Derive field expressions for different modes propagation in the waveguides. (L3)

UNIT – IV (10 Hrs)

Passive Microwave Devices: Introduction to scattering parameters and their properties, Terminations, Variable short circuit, Attenuators, Phase shifters, Hybrid Tees (H-plane, E-plane, Magic Tees), Hybrid ring, Directional Couplers – Bethe hole and Two-hole Couplers, Microwave propagation in Ferrites, Microwave devices employing Faraday rotation – Isolator, Circulator, Deriving Scattering matrix for Microwave passive devices.

Microwave Amplifiers and Oscillators: Microwave Tubes: Linear Beam Tubes – Two cavity Klystron amplifier -velocity modulation, bunching process, output power, Reflex Klystron oscillator, power output and efficiency, Travelling Wave Tube (TWT) – Bunching process and amplification process (Qualitative treatment only). Crossed Field Tubes – Magnetron oscillator.

Learning Outcomes: At the end of this unit, students should be able to

- Understand principle of operation of all passive microwave devices. (L1)
- Derive the scattering matrix for the microwave devices. (L3)
- Understand the principle of Microwave Tubes and semiconductor devices. (L1)
- Derive the expressions power output and efficiency of all microwave devices. (L3)

UNIT – V (7 Hrs)

Microwave Semiconductor Devices: Gunn Oscillator – Principle of operation, Characteristics, Two valley model, IMPATT, TRAPATT diodes.

Antennas and Microwave Measurements: Sources of errors, Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by comparison, Absolute and 3-Antenna Methods). Description of Microwave bench-different blocks and their features, errors and precautions, Microwave power measurements, Measurement of attenuation, frequency, VSWR (low, medium, high), Measurement of 'Q' of a cavity, Impedance measurements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand principle of operation of microwave semiconductors. (L1)
- Differentiate Linear beam tubes and Crossfield Tubes in terms of operation and performance. (L5)

TEXTBOOKS:

1. "Antennas and Wave propagation", John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th Edition, 2010.
2. "Microwave devices and circuits", Samuel Y. Liao, Pearson Publishing, 3rd Edition, 2003.

REFERENCE BOOKS:

1. "Foundations for microwave engineering", R. E. Collin, John Wiley, 2nd Edition, 2002.
2. "Antenna Theory- Analysis and Design", C.A. Balanis, John Wiley & Sons, 2nd Edition, 2001.
3. "Microwave and Radar Engineering", M. Kulkarni, Umesh Publications, 4th Edition, 2009.
4. "Antenna and Wave Propagation", G.S.N Raju, Pearson Education India, 3rd Edition 2009.

Course Code	MICROPROCESSORS AND MICROCONTROLLERS		L	T	P	C
21A040421			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8086 and 8051
- To introduce assembly language programming concepts
- To explain memory and I/O interfacing with 8086 and 8051
- To introduce 16-bit and 32-bit microcontrollers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the Architecture of 8086 microprocessor **(K2)**
CO2: Develop 8086 Assembly language programs **(K3)**
CO3: Explain interfacing of 8086 with peripheral devices **(K3)**
CO4: Develop assembly language programs for 8051 Microcontroller **(K3)**
CO5: Illustrate interfacing of 8051 with peripheral devices **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO5	3	3	2	-	-	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

8086 Architecture: Evolution of Microprocessors, Main features of 8086, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize features of a microprocessor (L2)
- Understand the concepts of architecture of 8086. (L2)
- Explain about ISR and interrupt structure of 8086 (L2)
- Compare the minimum and maximum mode configurations of 8086 (L2)

UNIT – II (8 Hrs)

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

Learning Outcomes: At the end of this unit, students should be able to

- Understand instruction set of 8086 microprocessor (L2)
- Explain addressing modes of 8086 (L2)
- Develop assembly language programs for various problems (L3)

UNIT – III (10 Hrs)

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

Learning Outcomes: At the end of this unit, students should be able to

- Explain memory & I/O interfacing with 8086 (L3)
- Describe interfacing of 8086 with peripheral devices (L2)

UNIT – IV (9 Hrs)

8051 Microcontroller and Programming: Comparison of Microprocessor and Microcontroller, Main features of 8051, Architecture of 8051, 8051 pin diagram, Special Function Registers (SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

Learning Outcomes: At the end of this unit, students should be able to

- Describe architecture and features of Intel 8051 microcontroller (L2)
- Develop assembly language programs to perform various operations using 8051 (L3)
- Distinguish between microprocessor and a microcontroller (L2)

UNIT – V (9 Hrs)

Interfacing Microcontroller: Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation.

Advanced Microcontrollers: PIC and ARM processors.

Learning Outcomes: At the end of this unit, students should be able to

- Explain memory & I/O interfacing with 8051 (L3)
- Illustrate interfacing of 8051 with peripheral devices (L4)
- Understand the advancements in the processors (L2)

TEXTBOOKS:

1. "Microprocessors and Interfacing – Programming and Hardware", Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 1994.
2. "Advanced Microprocessors and Peripherals", K M Bhurchandi, A K Ray, McGraw Hill Education, 3rd Edition, 2017.
3. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2nd Edition, 2012.

REFERENCE BOOKS:

1. "Microprocessor 8086 Architecture, Programming, Interfacing", Sunil Mathur, PHI Learning Private Limited, 2011.
2. "The 8051 Microcontroller", Kenneth J. Ayala, Cengage Learning, 3rd Edition, 2004.
3. "Embedded Systems Fundamentals on Arm Cortex-M based Microcontrollers: A Practical Approach", Alexander G. Dean

ONLINE LEARNING RESOURCES:

1. https://www.tutorialspoint.com/microprocessor/microprocessor_overview.htm
2. https://www.geeksforgeeks.org/architecture-of-8086/
3. https://www.javatpoint.com/microcontroller
4. https://computer.howstuffworks.com/microprocessor.htm
5. https://robu.in/8051-microcontroller/

Course Code	DIGITAL SIGNAL PROCESSING		L	T	P	C
21A040422			3	0	0	3
Pre-requisite	Signals and Systems	Semester	VI			

COURSE OBJECTIVES:

- To describe discrete time signals and systems.
- To teach importance of FFT algorithm for computation of Discrete Fourier Transform.
- To expose various implementations of digital filter structures.
- To present FIR and IIR Filter design procedures.
- To outline need of Multi-rate Processing

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Establish difference equations for the discrete time systems. **(K3**)
CO2: Apply FFT algorithms for determining the DFT of a given signal. **(K3)**
CO3: Design IIR digital filter from the given specification. **(K5)**
CO4: Design FIR digital filter from the given specifications. **(K5)**
CO5: Explain the concept of multi-rate DSP and quantization errors **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (8 Hrs)

Introduction to discrete time signals and systems: Introduction to digital signal processing, review of discrete-time signals and systems, analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different types of signals and systems. (L2)
- Describe discrete time signal. (L2)
- Analyse the linear time-invariant systems by Z transform. (L3)

UNIT – II (9 Hrs)

Discrete Fourier Transform: Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transforms: Efficient computation of DFT algorithms - Radix 2-Decimation- in-Time & Decimation-in-Frequency algorithms, Inverse FFT, Illustrative problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of DFT and its properties. (L2)
- Determine N-Point DFT/FFT for a given signal/sequence. (L3)

<u>UNIT – III</u> (10 Hrs)

IIR Filters: Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations ,Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand signal flow graph and block diagram representations of difference equations to realize different structures for IIR filters. (L2)
- Design of IIR filters using different techniques. (L5)

<u>UNIT – IV</u> (10 Hrs)

FIR Filters: Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Hanning, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of FIR filter and realize different structures for FIR filters (L2)
- Design FIR filter using windowing methods. (L5)

<u>UNIT – V</u> (8 Hrs)

Quantization Errors in Digital Signal Processing: Representation of numbers, Quantization of filter coefficients, Round-off Effects in digital filters.

Multi-rate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Polyphase decomposition.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the types Quantization of errors. (L2)
- Explain the quantization of filter coefficients. (L3)
- Understand the concept of multi-rate Digital Signal Processing. (L2)
- Explain the input and output spectrum of Decimation and Interpolation. (L3)

TEXTBOOKS:

1. "Digital Signal Processing, Principles, Algorithms, and Applications", John G. Proakis, Dimitris G. Manolakis, Pearson Education, 2007.
2. "Discrete Time Signal Processing", A. V. Oppenheim and R.W. Schaffer, PHI.
3. "Digital Signal Processing", Avtar Singh and S. Srinivasan, Thomson Publications, 2004.

REFERENCE BOOKS:

1. "Digital Signal Processing – A practical approach", S.K.Mitra, Pearson Education, 2nd Edition, New Delhi, 2004.
2. "Digital Signal Processing", M H Hayes, Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. "Fundamentals of Digital Signal Processing using MATLAB", Robert J. Schilling, Sandra L. Harris, Thomson, 2007.
4. "Digital Signal Processors, Architecture, Programming and Applications", B. Venkata Ramani and M. Bhaskar, TMH, 2004.

ONLINE LEARNING RESOURCES:

1. https://www.tutorialspoint.com/digital_signal_processing/index.htm
2. https://nptel.ac.in/courses/117102060
3. https://nptel.ac.in/courses/108106151
4. https://ccrma.stanford.edu/~jos/mdft/mdft.html

Course Code	OPTICAL COMMUNICATIONS		L	T	P	C
21A040423			3	0	0	3
Pre-requisite	Analog Communications, Digital Communications	Semester	VI			

COURSE OBJECTIVES:

- To understand the construction and characteristics of optical fibre cable.
- To develop the knowledge of different losses that occur in optical fibre.
- To develop the knowledge of optical signal sources.
- To identify and understand the operation of various optical detectors.
- To understand the design of optical systems and WDM.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the constructional parameters of optical fibre **(K4)**
CO2: Estimate the losses due to attenuation, absorption, scattering and bending. **(K4)**
CO3: Analyse the operation of optical signal sources. **(K4)**
CO4: Compare various optical detectors. **(K4)**
CO5: Explain the design of optical systems and WDM. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Overview of Optical Fiber Communication: - Historical development, The general system, Advantages of Optical Fiber Communications, Optical Fiber Wave Guides- Introduction, Ray Theory Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays, Cylindrical Fibers- Modes, V number, Mode Coupling, Step Index Fibers, Graded Index Fibers. Single Mode Fibers- Cut Off Wavelength, Mode Field Diameter, Effective Refractive Index.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Optical fibre Communications & Ray theory transmission. (L2)
- Apply the concepts to solve problems on AA, NA, V number (L3)
- Analyse Single Mode fibre parameters (L4)

UNIT – II (8 Hrs)
Signal Distortion in Optical Fibers: Attenuation, Absorption, Scattering and Bending Losses, Core and Cladding Losses, Transmission Efficiency, Information Capacity Determination, Group Delay, Types of Dispersion - Material Dispersion, Wave-Guide Dispersion, Polarization Mode Dispersion, Intermodal Dispersion, Pulse Broadening, Optimization of Single Mode Fibers.
Learning Outcomes: At the end of this unit, students should be able to

- Understand different types of losses that occur in Optical Fibers (L2)
- Analyse various Dispersion losses that occur in Optical Fibres. (L4)
- Understand how to make use of SMF's for long distance communication by optimization techniques. (L2)

UNIT – III (10 Hrs)
Fiber Splicing & Optical Sources: Splicing Techniques, Splicing Single Mode Fibers, Fiber Alignment and Joint Loss- Multimode Fiber Joints, Single Mode Fiber Joints. Optical Sources- LEDs, Structures, Materials, Quantum Efficiency, Power, Modulation, Power Bandwidth Product, Laser Diodes- Modes, Threshold Conditions, External Quantum Efficiency, Laser Diode Rate Equations, Resonant Frequencies
Learning Outcomes: At the end of this unit, students should be able to

- Understand different types of splicing techniques to join Optical Fibers (L2)
- Understand the construction & working principle of Optical light sources (L2)
- Analyse the operation of optical signal sources. (L4)

UNIT – IV (10 Hrs)
Optical Detectors & Optical Receiver: Physical Principles of PIN and APD, Detector Response Time, Temperature Effect on Avalanche Gain, Comparison of Photo Detectors, Optical Receiver Operation- Fundamental Receiver Operation, Pre-amplifiers, Digital Signal Transmission, Error Sources, Receiver Configuration, Digital Receiver Performance, Probability of Error, Quantum Limit.
Learning Outcomes: At the end of this unit, students should be able to

- Understand the operating principle of photo detector. (L2)
- Estimate the Probability of Error of Optical Receiver. (L4)
- Compare the Performance of different Pre-amplifiers. (L4)

UNIT – V (7 Hrs)
Optical System Design & WDM: Considerations, Component Choice, Point-to- Point Links, Digital Optical Fiber link System Considerations, Link Power Budget, Rise Time Budget, Power penalties, WDM, Necessity, Principles, Types of WDM.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts Design considerations. (L2)
- Understand the concepts of WDM (L2)
- Explain Link Power budget & Rise time budget for Digital Optical Fiber link. (L3)
- Design a Digital Optical Fibre link. (L3)

TEXTBOOKS:

1. "Optical Fiber Communications", Gerd Keiser, Mc Graw Hill Education, 4th Edition, 2008.
2. "Optical Fiber Communications", John M. Senior, Pearson Education, 3rd Edition, 2009.

REFERENCE BOOKS:

1. "Fiber Optic Communications", D.K. Mynbaev, S. C. Gupta and Lowell L. Scheiner, Pearson Education, 2005.
2. "Optical Fibre Communication and its Applications", S. C. Gupta, PHI, 2005.

ONLINE RESOURCE LINKS:

1. https://nptel.ac.in/courses/108106167
2. https://www.tutorialspoint.com/Fiber-Optic-Communications

<table>
<tr><td>Course Code</td><td rowspan="2">SMART SENSORS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A040424</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Electronic measurement and Instrumentation</td><td>Semester</td><td colspan="4">VI</td></tr>
</table>

COURSE OBJECTIVES:

- To understand measuring parameters, measuring systems and characteristics and parameters to be considered for designing an instrument
- Understand different types of sensors/transducers, working principles, selection procedure, applications of sensing systems.
- Select a sensor/sensing system for a requirement.
- Derive sensor-based solution for different applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe measuring parameters measuring systems, effects of environment, characteristics and parameters to be considered for designing an instrument. **(K3)**

CO2: Choose different types of temperature, humidity, moisture, pressure and force sensors for different applications and explain their working principles. **(K3)**

CO3: Select different types of Occupancy, motion detectors, velocity and acceleration sensors for different applications and explain their working principles. **(K3)**

CO4: Choose different types of flow, acoustic, light and radiation, chemical sensors for different applications and explain their working principles. **(K3)**

CO5: Analyze different sensor network architectures for wireless applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	3	3
CO2	3	2	2	1	-	-	-	-	-	-	-	3	3	3
CO3	3	2	2	1	-	-	-	-	-	-	-	3	3	3
CO4	3	2	2	1	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	1	-	-	-	-	-	-	-	3	3	3

UNIT – I (10 Hrs)

Introduction to Measurement: Measurement units, applications, elements, choosing appropriate measuring instruments. Instrument Types and Performance Characteristics: Review of instrument types, Static characteristics, dynamic characteristics Error during measurement process: Sources of systematic error, reduction and quantification of systematic errors, random errors, aggregation of measurement system errors. Calibration: Calibration of measuring instruments, Primary calibration, secondary calibration and field calibration. Calibration methods for different parameters (temperature, pressure, humidity, flow...etc.). Automatic Calibration mechanisms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different measurement parameters. (L2)
- Explain the static and dynamic characteristics of instruments. (L2)
- Develop the knowledge of calibrating a measuring instrument. (L3)

UNIT – II (9 Hrs)

Temperature Sensors: Thermo-resistive, Resistance Temperature Detectors, Silicon Resistive, Thermistors, Semiconductor, Optical, Acoustic, Piezoelectric

Humidity and Moisture Sensors: Capacitive, Electrical Conductivity, Thermal Conductivity, Optical Hygrometer, Time Domain Reflect meter.

Pressure and Force Sensors: Mercury Pressure, Bellows, Membranes, and Thin Plates, Piezoresistive, Capacitive, Optoelectronic, Vacuum, Strain Gauges, Tactile, Piezoelectric Force.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the operating principles of temperature, humidity, moisture, pressure and force sensors. (L2)
- Choose various sensors for measuring temperature, humidity, moisture, pressure and force sensors in different environments. (L3)
- Compare different types of temperature, humidity, moisture, pressure and force sensors. (L2)

UNIT – III (9 Hrs)

Occupancy and Motion Detectors: Ultrasonic, Microwave Motion, Capacitive Occupancy, Visible and Near-Infrared Light, Far-Infrared Motion, PIR Motion, Position, Displacement, and Level Sensors: Potentiometric, Gravitational, Capacitive, Inductive and Magnetic, Optical, Ultrasonic, Radar Velocity and Acceleration Sensors: Capacitive Accelerometers, Piezoresistive Accelerometers, Piezoelectric Accelerometers, Thermal Accelerometers, Heated-Plate Accelerometer, Heated Gas Accelerometer, Gyroscopes, Piezoelectric Cables

Learning Outcomes: At the end of this unit, students should be able to

- Understand the operating principles of occupancy & motion detectors, velocity and acceleration sensors. (L2)
- Select various sensors for measuring occupancy & motion detectors, velocity and acceleration sensors in different environments. (L3)
- Compare different types of occupancy & motion detectors, velocity and acceleration sensors. (L2)

UNIT – IV (8 Hrs)

Flow Sensors: Pressure Gradient Technique, Thermal Transport, Ultrasonic, Electromagnetic, and Micro flow, Coriolis Mass Flow, Acoustic Sensors: Resistive Microphones, Fiber-Optic, Piezoelectric, Solid-State microphone, Light & Radiation Sensors: Photodiodes, Phototransistor, Photo resistors, Thermal detectors

Chemical Sensors: Metal-Oxide Chemical, ChemFET, Electro-chemical, Potentiometric, Conduct metric, Amperometric, Optical Chemical, Mass Detector

Learning Outcomes: At the end of this unit, students should be able to

- Understand the operating principles of flow, acoustic, light & radiation and chemical sensors. (L2)
- Choose various sensors for measuring flow, acoustic, light & radiation and chemical sensors in different environments. (L3)
- Compare different types of flow, acoustic, light & radiation and chemical sensors. (L2)

UNIT – V (9 Hrs)

Introduction to wireless sensor networks, Challenges for wireless sensor networks, Applications for wireless sensor networks, enabling technologies for wireless sensor networks.

Single node architecture – Hardware components, Energy consumption of Sensor nodes (only Operation states with different power consumption, Relationship between computation and communication, Power consumption of sensor and actuators is included), Deployment environments

Sensor Network Architecture - Sensor Network Scenarios, Optimization goals and figures of merit, Design principles of WSN, Service interfaces of WSNs, Gateway-concepts.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the operating principles of wireless sensor networks. (L2)
- Identify different parameters to evaluate wireless sensor networks. (L2)

TEXTBOOKS:

1. “Measurement and Instrumentation Principles”, Alan S Morris, Butterworth-Heinemann Imprint, 3rd Edition, 2001
2. “An Introduction to Error Analysis”, John R Taylor, 2nd Edition, 1997
3. “Sensor Technology Handbook”, John S Wilson, Elsevier Science, 2004
4. "Protocols and Architectures for Wireless Sensor Networks”, Holger Karl & Andreas Willig, John-Wiley, 1st Edition, 2014.

REFERENCE BOOKS:

1. “Mechanical Measurements”, Beckwith, Marangoni, Lienhard, Pearson Education India, 6th Edition, 2013
2. “Measurement of Systems - Application and design”, Earnest O. Doeblin, McGraw Hill Higher Education, 5th Edition, 2008
3. “Electronic Instrumentation and Measurement Techniques”, Albert D Helfrick, Prentice Hall, 3rd Edition, 1985

4. “Wireless Sensor Networks- Technology, Protocols, And Applications”, Kazem Sohraby, Daniel Minoli, & Taieb Znati, John Wiley, 2007.

<table>
<tr><td>Course Code</td><td rowspan="2">VLSI DESIGN</td><td colspan="2">L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A040425</td><td colspan="2">3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Electronic Devices and Circuits, Digital System Design</td><td>Semester</td><td colspan="4">VI</td></tr>
</table>

COURSE OBJECTIVES:

- Learn and Understand IC Fabrication process steps required for various MOS circuits.
- Understand and Experience VLSI Design Flow.
- Learn Transistor-Level CMOS Logic Design.
- Understand VLSI Fabrication and Experience CMOS Physical Design.
- Learn to Analyze Gate Function and Timing Characteristics.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain about IC fabrication and relation between different parameters of MOSFET showing its characteristics. **(K3)**

CO2: Estimate sheet resistance, area capacitance, delays in CMOS circuits and develop layouts, stick diagrams of logic circuits using Lambda based rules. **(K4)**

CO3: Design MOSFET based logic circuits using various logic styles like static and dynamic CMOS. **(K5)**

CO4: Analyze the various test generation methods for static and dynamic CMOS circuits. **(K4)**

CO5: Analyze the behaviour of amplifier circuits with various loads. **(K4)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	3	-	-	-	-	-	-	3	3	3
CO3	3	3	3	2	3	-	-	-	-	-	-	3	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	3	3	3

UNIT – I (9 Hrs)

Introduction and Basic Electrical Properties of MOS Circuits: VLSI Design Flow, Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. Ids versus Vds relationships, Aspects of MOS transistor: Threshold Voltage, Trans Conductance, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-ups, The CMOS Inverter, Latch-up in CMOS circuits, Bi-CMOS Inverter, Comparison between CMOS and BiCMOS technology.

Learning Outcomes: At the end of this unit, students should be able to

- Understand fabrication process flow. (L2)
- Explain different MOSFET Inverters. (L3)

UNIT – II (9 Hrs)

Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, Some area Capacitance Calculations, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Switch logic, Gate logic, Choice of layers, Stick Diagrams, Design Rules and Layout Diagrams for MOS circuits.

Scaling of MOS Circuits: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise and current density.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic circuit concepts to MOS circuits. (L3)
- Apply the design Rules and draw layout of a given logic circuit (L3).
- Estimate the sheet resistance, square capacitance and propagation delays in CMOS circuits (L4)

UNIT – III (9 Hrs)

CMOS Combinational and sequential logic circuit design:

Static CMOS Design: Complementary CMOS, Ratioed Logic, Pass-Transistor Logic.

Dynamic CMOS Design: Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates, Choosing a Logic Style, Timing Metrics for Sequential Circuits, Latches Vs Register, The Bistability Principle, SR Flip-Flops, Multiplexer-Based Latches, Master-Slave Edge-Triggered Register, Reduced load clock load static master-slave register, C2MOS—A Clock-Skew Insensitive approach Pipelining.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the behaviour of static and dynamic logic circuits. (L4)
- Design MOSFET based logic circuits using various logic styles like static and dynamic CMOS. (L5)

UNIT – IV (9 Hrs)

Fault Modeling & Testing : Fault classes and models–Stuck at faults, bridging faults, transition and intermittent faults. Design for Testability, Testing Combinational Logic-Path Sensitization technique, Boolean difference method, Testing Sequential Logic, Practical Design for Test (OFT) Guidelines, Scan Design Techniques, Built-In-Self-Test (BIST).

Learning Outcomes: At the end of this unit, students should be able to

- Identify the design for testability methods for combinational & sequential CMOS circuits. (L2)
- Analyze the various test generation methods for static and dynamic CMOS circuits. (L4)

UNIT – V (9 Hrs)

Basic building blocks of Analog IC design: Regions of operation of MOSFET, Modelling of transistor, body bias effect, biasing styles, single stage amplifier with resistive load, single stage amplifier with diode connected load, Common Source amplifier, Common Drain amplifier, Common Gate amplifier.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the behaviour of amplifier circuits with various loads. (L4)
- Design amplifier circuits using MOS transistors. (L3)

TEXTBOOKS:

1. "Essentials of VLSI Circuits and Systems", Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, Prentice Hall of India Private Limited, 2005.
2. "Design of Analog CMOS Integrated Circuits", Behzad Razavi , McGraw Hill, 2003
3. "Digital Integrated Circuits", Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, Prentice-Hall of India Private Limited, 2nd Edition, 2009.

REFERENCE BOOKS:

1. "Introduction to VLSI Circuits and Systems", John P. Uyemura, John Wiley & Sons, reprint 2009.
2. "Logic Design Theory", N.N. Biswas, Prentice Hall of India, 1st Edition, 2002

Course Code	ANTENNAS & MICROWAVE ENGINEERING LAB		L	T	P	C
21A040426			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the working, different microwave components and verify characteristics using microwave bench setup.
- To study characteristics and radiative patterns of various antennas

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the working of different microwave components and sources in a microwave bench. **(K2)**

CO2: Compare the characteristics of various microwave components using microwave bench setup. **(K4)**

CO3: Simulate various antennas. **(K3)**

CO4: Analyse performance characteristics of Antennas **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	-	-	-	-	3	3	-	3	3	-
CO2	3	3	2	2	-	-	-	-	3	3	-	3	3	-
CO3	3	2	2	2	-	-	-	-	3	3	-	3	3	-
CO4	3	3	2	2	-	-	-	-	3	3	-	3	3	-

LIST OF EXPERIMENTS:

Part-A: ANTENNAS LAB

1. Analyze the characteristics of Simple Dipole λ/2 and λ/4 Antenna
2. Analyze the variation in the Radiation Strength at given distance from Antenna
3. Analyze the Reciprocity Theorem for Antennas
4. Simulate Folded Dipole λ /2 Antenna
5. Simulate Yagi Uda 3 element Folded Dipole, 5 element folded dipole.
6. Analyze the characteristics and radiation pattern of broad side and end fire arrays.
7. Analyze the characteristics of micro strip antennas.

Part-B: MICROWAVE ENGINEERING LAB

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Directional Coupler Characteristics.
4. VSWR Measurement.
5. Measurement of Scattering Parameters of a Magic Tee.
6. Measurement of Scattering Parameters of a Circulator.
7. Attenuation Measurement.
8. Microwave Frequency Measurement.

SOFTWARE REQUIRED:

1. ADS / HFSS / CST or any equivalent simulation software

NOTE: At least 6 Experiments from each section shall be performed

Course Code	MICROPROCESSORS AND MICOCONTROLLERS LAB		L	T	P	C
21A040427			**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To acquire the knowledge on microprocessors and microcontrollers
- To interfacing various peripherals
- To Learn Assembly/Embedded C programming approach for solving real world problems
- To configure and develop programs to interface peripherals/sensors

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Examine problems and implement algorithms using Assembly language. **(K4)**
CO2: Develop programs for different applications. **(K3)**
CO3: Connect peripheral devices with 8086. **(K4)**
CO4: Connect peripheral devices with 8051. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	3	3	-	3	-	3
CO2	3	2	2	2	-	-	-	-	3	3	-	3	-	3
CO3	3	3	2	2	-	-	-	-	3	3	-	3	-	3
CO4	3	3	2	2	-	-	-	-	3	3	-	3	-	3

LIST OF EXPERIMENTS:

1. PROGRAMS FOR 16 BIT ARITHMETIC OPERATIONS (Using various addressing modes)
   a) Write an ALP to Perform Addition and Subtraction of Multi precision numbers.
   b) Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
   c) Write an ALP to find square, cube and factorial of a given number.
2. PROGRAMS INVOLVING BIT MANIPULATION INSTRUCTIONS
   a) Write an ALP to find the given data is positive or negative.
   b) Write an ALP to find the given data is odd or even.
   c) Write an ALP to find Logical ones and zeros in a given data.
3. PROGRAMS ON ARRAYS FOR 8086
   a) Write an ALP to find Addition/subtraction of N numbers.
   b) Write an ALP for finding largest/smallest number.
   c) Write an ALP to sort given array in Ascending/descending order.
4. PROGRAM FOR STRING MANIPULATIONS FOR 8086
   a) Write an ALP for Displaying the given String.
   b) Write an ALP to find String length.
   c) Write an ALP for Comparing two Strings.

   d) Write an ALP to reverse String.
5. PROGRAM FOR DIGITAL CLOCK DESIGN USING 8086
   a) Write an ALP for Designing clock using INT 21H Interrupt.
   b) Write an ALP for Designing clock by reading system time.
6. INTERFACING STEPPER MOTOR WITH 8086
   a) Write an ALP to 8086 processor to Interface a stepper motor and operate it in clockwise by choosing variable step-size.
   b) Write an ALP to 8086 processor to Interface a stepper motor and operate it in Anti-clockwise by choosing variable step-size.
7. INTERFACING ADC/DAC WITH 8086
   a) Write an ALP to 8086 processor to Interface ADC.
   b) Write an ALP to 8086 processor to Interface DAC and generate Square Wave/Triangular Wave/Staircase Wave.
8. COMMUNICATION BETWEEN TWO MICROPROCESSORS
   a) Write an ALP to have Parallel communication between two microprocessors using 8255
   b) Write an ALP to have Serial communication between two microprocessor kits using 8251
9. PROGRAMS USING ARITHMETIC AND LOGICAL INSTRUCTIONS FOR 8051
   a) Write an ALP to 8051 Microcontroller to perform Arithmetic operations like Addition, Subtraction, Multiplication and Division.
   b) Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
10. PROGRAM TO VERIFY TIMERS OF 8051
   a) Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
   b) Write a program to create a delay of 50 µsec using Timer1 in mode 0 and blink all the Pins of P2.
11. UART OPERATION IN 8051
   a) Write a program to transfer a character serially with a baud rate of 9600 using UART.
   b) Write a program to transfer a character serially with a baud rate of 4800 using UART.
12. INTERFACING LCD WITH 8051
   Develop and execute the program to interface16*2 LCD to 8051.

REFERENCE BOOKS:

1. "The 8051 microcontroller", Kenneth. J. Ayala, Cengage learning, 3rd Edition, 2010.
2. "Advanced microprocessors and peripherals", A. K. Ray and K. M. Bhurchandani, TMH, 2nd Edition, 2006.
3. "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Muhammad Ali Mazidi, Janice Gillispie Mazidi, 2nd Edition.

Note: Any TEN of the above experiments shall be performed.

Course Code	DIGITAL SIGNAL PROCESSING LAB		L	T	P	C
21A040428			0	0	3	1.5
Pre-requisite	Signals and Systems	Semester	VI			

COURSE OBJECTIVES:

- To familiarize students with practical implementation of the digital signal processing.
- To apply knowledge of mathematics, science and engineering**:** Construction of tools for visualizing the basic concepts of discrete signal representation such as Fourier transforms, discrete time representations.
- To learn numerous programming tools for design and of filtering implementations algorithms.
- To understand the concept of multi-rate signal processing and sample rate conversion.
- To develop and implement DSP algorithms in software using CCS with DSP floating point processor

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Implement various DSP Algorithms using MATLAB / Code Composer Studio (CCS). (**K3**)

CO2: Analyze and observe magnitude and phase characteristics (Frequency response characteristics) of digital IIR-Butterworth, Chebyshev filters. (**K4**)

CO3: Analyze and observe magnitude and phase characteristics (Frequency response characteristics) of digital FIR filters using window techniques. (**K4**)

CO4: Design and Analyze Digital Filters using FDA Tool. (**K5**)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	3	3	-	3	3	-
CO2	3	3	2	2	2	-	-	-	3	3	-	3	3	-
CO3	3	3	2	2	2	-	-	-	3	3	-	3	3	-
CO4	3	3	3	3	3	-	-	-	3	3	-	3	3	-

LIST OF EXPERIMENTS:

1. Generate the following standard discrete time signals.
   i) Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Sawtooth
2. Generate the sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Find frequency response of a system given in transfer function/ differential equation form.
4. Implement and verify linear and circular convolution between two given signals.

5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT & IFFT of a given sequence and find the frequency response (magnitude and phase).
7. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
8. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique.
    i. Using rectangular window
    ii. Using hamming window
    iii. Using Kaiser window
10. Design and verify IIR/ FIR Filter frequency response by using Filter design and Analysis (FDA) Tool.
11. Compute the Decimation and Interpolation for the given signal.
12. Study the architecture of DSP chips – TMS 320C 5X/6X Instructions.
13. Find DFT / IDFT of given discrete time signal.
14. Design and implementation of IIR Butterworth / Chebyshev (LP/HP) filter.
15. Design and implementation of FIR with low pass / high pass filter using any windowing technique. Plot its magnitude and phase response.

Note:

1. The experiments 1 to 12 shall be conducted using MATLAB / Lab View / C Programming/ Equivalent software & experiments 13 to 15 shall be conducted using TI / Analog Devices / Motorola / Equivalent DSP processors.
2. Any twelve of the above experiments shall be performed.

REFERENCE BOOKS:

1. “Discrete Time Signal Processing”, A. V. Oppenheim and R.W. Schaffer, PHI.
2. “Digital Signal processing”, S.K. Mitra, TMH, 2nd Edition

ONLINE LEARNING RESOURCES:

1. http://vlabs.iitkgp.ac.in/dsp/#

Course Code	RF SYSTEM DESIGN		L	T	P	C
21A010703			1	0	2	2
Pre-requisite	Electronic Circuit Analysis and Design, Antennas and Microwave Engineering	Semester	VI			

COURSE OBJECTIVES:

- Verify the basic principles and design aspects involved in high frequency communication systems components.
- Conduct the experiments on different high frequency components to analyze and interpret data to produce meaningful conclusion and match with theoretical concepts.
- Design and develop RF components using microstrip technology.
- Apply knowledge of basic RF Electronics for realizing any RF system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design various RF passive and active components and analyze their performance. **(K5)**

CO2: Design and Evaluate the performance of RF circuits S-parameters, Signal flow graphs and smith charts. **(K5)**

CO3: Analyze the performance of RF Microstrip antennas. **(K4)**

CO4: Design and Analyze Microstrip Transmission Line standing wave pattern at various frequencies. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	3	3	-	3	3	3
CO2	3	3	3	3	3	-	-	-	3	3	-	3	3	3
CO3	3	3	2	2	3	-	-	-	3	3	-	3	3	3
CO4	3	3	2	2	3	-	-	-	3	3	-	3	3	3

UNIT – I

Basic Concepts in RF Design: Introduce any RF design software and orient students with the tools of the laboratory. Practice the tool to use it for significant design. Introduction to RF Design, Time Variance and Nonlinearity, Effects of nonlinearity, Passive impedance transformation, Scattering parameters, impedance matching, L match, Pi match, T match, Passive IC Components-Resistors, Capacitors Inductors, Schottky Diode, RF Switch.

UNIT – II

RF Power Amplifiers and Filters: RF Power amplifier design examples, Gain equalizers, Voltage controlled oscillators, Phase Locked Loops, Linearized PLL models, High frequency oscillators, LPF, HPF and BPF.

UNIT – III

LNA, VCO and Mixers: General considerations, Problem of input matching, Low Noise Amplifiers design in various topologies, Gain Switching, Band Switching, Voltage Controlled Oscillators, Mixers-General considerations.

UNIT – IV

Microstrip transmission lines and discontinuities: S parameters of a Microstrip Transmission Line, Smith Chart, Analysis of Microstrip Transmission Line standing wave patterns at various frequencies, Different types of Transmission lines like CPW, Microstrip and Co-axial cable. Different types of Microstrip discontinuities like Bend, T, Via, Gap etc., Microstrip Ring Resonator.

LIST OF EXPERIMENTS:

1. Design of λ/2, λ/4 Microstrip Transmission line.
2. Design of Microstrip Inductor and Capacitor.
3. Design of Impedance matching network.
4. Design and Simulate a Schottky Diode and RF Switch.
5. Design and characterization of RF BJT Amplifier and LNA.
6. Analyse and measure the gain of a Power Amplifier and equalise its gain using an Equalizer.
7. Design of Low pass, High pass, Band pass and Band stop filter at RF.
8. Design and characterization of RF Mixer.
9. Design and characterization of VCO.
10. Measure the S parameters of a Microstrip Transmission Line and plot the normalised impedance on a Smith chart.
11. Analysis of Microstrip Transmission Line standing wave pattern at various frequencies.
12. Study of different types of Transmission lines like CPW, Microstrip and Co-axial and find/measure its Insertion Loss (S21 and S12).
13. Study of different types of Microstrip discontinuities like Bend, T, Via, Gap etc and find/measure its Insertion loss.
14. Design and characterization of Microstrip Patch Antennas.
15. Determine the Bandwidth and Quality Factor of a Microstrip Ring Resonator.

SOFTWARE REQUIRED:

1. ADS/IE3D/HFSS or any similar/ equivalent tool

Note: Minimum Twelve experiments shall be performed.

REFERENCE BOOKS:

1. “Design of CMOS RF Integrated Circuits”, T. Lee, Cambridge, 2004.
2. “RF circuit design”, Reinhold Ludwig and Pavel Bretchko, Pearson Education, 2007.
3. “RF Microelectronics”, B. Razavi, Pearson Education, 2012.

Course Code	RESEARCH METHODOLOGY (Common to all branches)		L	T	P	C
21A000004			2	0	0	0
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know how to define a Research problem, select suitable design and experimental approach. **(K1)**
CO2: Formulate sampling design and various techniques implemented on data collection. **(K6)**
CO3: Correlate any two variables and find the solution using regression analysis. **(K4)**
CO4: Examine hypothesis testing procedure, Analyze the significance of variance and covariance. **(K4)**
CO5: Write a report on research work for seminars, conferences formats. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (6 Hrs)

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of research and its process. (L2)
- Explain various types of research. (L2)
- Explain the steps involved in research design. (L2)
- Understand the different research approaches. (L2)

UNIT – II (6 Hrs)

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of sampling and sampling design. (L2)
- Explain various techniques in measurement and scaling. (L2)
- Understand various methods of data collection. (L2)
- Design survey questionnaires for different kinds of research. (L3)
- Analyze the questionnaires. (L4)

UNIT – III (6 Hrs)

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of correlation and regression. (L2)
- Compare and contrast correlation and regression. (L3)
- Explain various types of correlation. (L3)
- Apply the knowledge of C&R Analysis to get the results. (L3)

UNIT – IV (6 Hrs)

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Understand the hypothesis testing procedure. (L2)
- Compare and contrast Parametric and Non-parametric Tests. (L3)
- Understand the use of chi-square test in investigating the distribution of categorical variables. (L2)
- Analyze the significance of variance and covariance. (L4)

UNIT – V (6 Hrs)

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how to write a report and research paper. (L2)
- Explain various techniques of interpretation. (L2)
- Understand the importance of professional ethics in research. (L2)

- Design a scientific paper to present in the conferences/seminars. (L3)

TEXTBOOKS:

1. "Research Methodology: Methods and Techniques", C.R.Kothari, New Age International Publishers, 2nd Edition,.
2. "Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, Sage Publications

REFERENCE BOOKS:

1. "Research Methodology and Statistical Tools", P. Narayana Reddy and G. V. R. K. Acharyulu, Excel Books, New Delhi, 1st Edition.
2. "Business Research Methods", Donald R. Cooper & Pamela S Schindler, 9th Edition.
3. "Fundamentals of Statistics", S C Gupta, Himalaya Publications, 7th Edition

Course Code	EMBEDDED SYSTEM DESIGN		L	T	P	C
21A040429			3	0	0	3
Pre-requisite	Microprocessors and Microcontrollers	Semester	VII			

COURSE OBJECTIVES:

- To understand the basics of an embedded system and RTOS
- To introduce the typical components of an embedded system
- To explain interfacing of various communication and I/O devices to an embedded system
- To provide knowledge on the design process of embedded system applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the basic concepts of an embedded system **(K3)**

CO2: Explain the role of system core, memory, sensors, actuators, I/O and other subsystem components in an embedded system **(K3)**

CO3: Explain the different communication interfaces of an embedded system **(K3)**

CO4: Describe various steps involved in design and development of embedded firmware **(K3)**

CO5: Explain the functions of RTOS **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	2	2	-	-	-	-	-	-	-	3	-	3
CO3	3	3	2	-	-	-	-	-	-	-	-	3	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

Introduction to Embedded Systems: History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software components, system integration, Applications of embedded systems, and characteristics of embedded systems.

Learning Outcomes: At the end of this unit, students should be able to

- Classify embedded systems based on generation, complexity and performance (L2)
- Discuss the characteristics of an embedded system (L2)
- Explain the design process in embedded system (L3)

UNIT – II (9 Hrs)

Typical Embedded System: Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss about the core of the embedded system (L2)
- Summarize different factors to be considered in the selection of memory for an embedded system (L2)
- Explain role of sensors, actuators, I/O components and other subsystem components used in embedded system (L3)

UNIT – III (9 Hrs)

Communication Interface: Onboard communication interfaces - I2C, SPI, CAN, parallel interface; External communication interfaces - RS232, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various types of on-board communication interfaces (L3)
- Describe the external communication interfaces used in embedded system (L2)
- Discuss the different types of wireless communication interfaces used in embedded system (L2)
- Illustrate different Inter Process Communication (IPC) mechanisms used by tasks / process / tasks to communicate in multitasking environment (L4)

UNIT – IV (9 Hrs)

Embedded Firmware Design and Development: Embedded firmware design approaches -super loop based approach, operating system based approach; embedded firmware development languages - assembly language based development, high level language based development.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the different approaches for embedded firmware design (L2)
- Discuss the different embedded firmware development languages (L2)
- Explain the process of Assembly language to machine language conversion and High-level language to machine language conversion (L3)
- Design simple embedded system based applications (L6)

UNIT – V (9 Hrs)

RTOS Based Embedded System Design: Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques

Learning Outcomes: At the end of this unit, students should be able to

- Explain about operating system and RTOS (L2)
- Differentiate multiprocessing and multitasking (L3)
- Discuss the various types of task scheduling (L2)
- Describe the task communication and synchronization (L3)
- Build RTOS based Embedded System for various applications (L6)

TEXTBOOKS:

1. "Introduction to Embedded Systems", Shibu K V, McGraw Hill Education, 2^{nd} edition, 2017.
2. "Embedded Systems: Architecture, Programming and Design", Raj Kamal, McGraw Hill Education, 3^{rd} edition, 2017

REFERENCE BOOKS:

1. "Computers as Components", Wayne Wolf, Morgan Kaufmann, Elsevier, 2^{nd} edition
2. "Embedded Systems- An integrated approach", Lyla b das, Pearson education, 2012
3. "Embedded Microcomputer Systems Real Time Interfacing", Jonathan W. Valvano, Cengage Learning, 3^{rd} edition, 2012.

Course Code	DSP PROCESSORS & ARCHITECTURES		L	T	P	C
21A040430			3	0	0	3
Pre-requisite	Digital Signal Processing	Semester	VII			

COURSE OBJECTIVES:

- To describe unique features of Digital signal processing.
- To understand the basics and various computational parameters of DSP devices.
- To understand the architectural improvements, On-chip Peripherals and Instruction set in programmable DSP devices.
- To outline DSP processors for developing various applications.
- To study the Advanced Programmable DSP Processors

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Summarize features of Digital Signal Processing and evaluate dynamic ranges and precision for the given DSP system (**K2**)

CO2: Explain architectural features of DSP processors (**K2**)

CO3: Analyze the performance of various TMS320C5xx DSP devices. (**K4**)

CO4: Analyze performance of various TMS320C6x and ADSP processors. (**K4**)

CO5: Select DSP processors for building real time applications (**K4**)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction: Signal Processing concepts, the sampling process, Review of Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Digital filters, Decimation and interpolation.

Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of Error in DSP Implementation, A/D Conversion Errors, D/A Conversion Errors

Learning Outcomes: At the end of this unit, students should be able to

- Understand the fundamentals of digital signal processing. (L2)
- Understand the source of errors in DSP implementations.(L2)

UNIT – II (8 Hrs)

Architecture for Programmable DSP Devices: Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Programmability and Program Execution, Speed Issues, On chip Peripherals, Commercial Digital Signal Processing Devices,

Learning Outcomes: At the end of this unit, students should be able to

- Understand the fundamentals of programmable digital signal processors. (L2)
- Describe the Architectural Features of programmable DSP processors. (L2)

UNIT – III (10 Hrs)

TMS320C54xx Processor: Features, Internal architecture, Data Addressing Modes, Memory space of TMS320C54xx Processors, TMS320C54xx Instructions and Programs

TMS320C55x Processor: Features, CPU and memory Architecture, Addressing modes and pipeline operations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the architecture and addressing modes of TMS320C5xx digital signal processors. (L2)
- Analyze the performance of various TMS320C5xx DSP devices.(L4)

UNIT – IV (9 Hrs)

TMS320C6x Processor: Features, Internal architecture, data paths and control register file, Addressing modes and pipeline operation and interrupts

ADSP Processors: Architecture of ADSP-21XX and ADSP-210XX series of DSP processors-Addressing modes

Learning Outcomes: At the end of this unit, students should be able to

- Understand the architecture and addressing modes of TMS320C6xx digital signal processors. (L2)
- Understand the architecture and addressing modes of ADSP Processors. (L2)
- Analyze the performance of various TMS320C6x and ADSP devices.(L4)

UNIT – V (9 Hrs)

Applications of Programmable DSP Devices: A DSP System, DSP Based Biotelemetry Receiver, A Speech Processing System, An Image Processing System.

Learning Outcomes: At the end of this unit, students should be able to

- Develop the algorithm suitable for signal processing applications. (L3)
- Select the suitable processor for the different applications. (L4)

TEXTBOOKS:

1. "Digital Signal Processors, Architecture, Programming and Applications", B. Venkataramani and M. Bhaskar, TMH, 2002.
2. "Digital Signal Processing", Avtar Singh and S. Srinivasan, Thomson Publications, 2004.

REFERENCE BOOKS:

1. "Algorithms for Statistical Signal Processing", J. G. Proakis, Pearson,2002.
2. "A Practical Approach to Digital Signal Processing", K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009
3. "DSP Processor Fundamentals - Architectures & Features", Lapsley et al., S. Chand & Co.,2000
4. User guides Texas Instruments, Analog Devices and NXP.

Course Code	SATELLITE COMMUNICATIONS		L	T	P	C
21A040431			3	0	0	3
Pre-requisite	Analog Communications, Digital Communications	Semester	VII			

COURSE OBJECTIVES:

- To understand the basic concepts, applications, frequencies used and types of satellite communications
- To understand the concept of look angles, launches and launch vehicles, orbital effects in satellite communications.
- To understand the various satellite subsystems and its functionality.
- To understand the concepts of satellite link design and calculation of C/N ratio.
- To understand the concepts of multiple access and various types of multiple access techniques in satellite systems
- To understand the concepts of satellite navigation, architecture and applications of GPS.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the historical background, orbital mechanics, launch vehicles and functional principles of satellite communication systems. **(K2)**

CO2: Apply reliability techniques for various subsystems of a satellite and study their role in satellite working. **(K3)**

CO3: Analyze a satellite link and suggest enhancements to improve the link performance. **(K4)**

CO4: Interpret the Earth station and tracking of the satellites. **(K5)**

CO5: Evaluate the low orbit geo-stationary satellite requirements and GPS. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-

UNIT – I (8 Hrs)

Introduction: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

Orbital Mechanics and Launchers: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of satellite and their applications. (L2)
- Understand the various orbital mechanics and launch vehicles. (L2)
- Understand the frequency allocations for Satellite communications. (L2)

<u>UNIT – II</u> (9 Hrs)

Satellite Subsystems: Altitude and orbit control system, telemetry, tracking, Command and Monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space Qualification

Learning Outcomes: At the end of this unit, students should be able to

- Understand the roles all the subsystems of a satellite. (L3)
- Explain the modules of satellite sub system and earth stations (L3).
- Apply reliability techniques for the space qualification of equipment. (L3)

<u>UNIT – III</u> (10 Hrs)

Satellite Link Design: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.

Multiple Access: Frequency division multiple access (FDMA) Inter modulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple access (CDMA), Spread spectrum transmission and reception.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various multiple access techniques (L2)
- Apply various multiple access techniques for satellite communications (L2)
- Apply frequency allocation standards, reliability techniques, multiple access techniques (L3)
- Analyze link budget of satellite signal for proper communication (L4)
- Design Uplink and Downlink of a satellite (L4)

<u>UNIT – IV</u> (9 Hrs)

EARTH STATION TECHNOLOGY: Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various subsystems of an earth station (L2).
- Apply power test methods to earth stations (L3).
- Choosing different kinds of transmitter and receiver antennas to provide Uplink and Down Link Frequency (L5).

UNIT – V (9 Hrs)

LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS: Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, Operational NGSO constellation Designs

SATELLITE NAVIGATION & THE GLOBAL POSITIONING SYSTEM: Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of low earth orbit and geo-stationary satellite systems (L2).
- Demonstrate the impacts of GPS, Navigation, NGSO constellation design for tracking and launching (L2).
- Analyze satellite navigation and global positioning system (L4).

TEXTBOOKS:

1. "Satellite Communications", Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. "Satellite Communications Engineering", Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, Pearson Publications, 2nd Edition, 2003.
3. "Satellite Communications", Robert M. Gagliardi, CBS Publications, 2nd Edition.

REFERENCE BOOKS:

1. "Satellite Communications: Design Principles", M. Richharia, BS Publications, 2nd Edition, 2003.
2. "Satellite Communication", D.C Agarwal, Khanna Publications, 5th Edition.
3. "Fundamentals of Satellite Communications", K. N. Raja Rao, PHI, 2004
4. "Satellite Communications", Dennis Roddy, McGraw Hill, 2nd Edition, 1996.

Course Code	CELLULAR AND MOBILE COMMUNICATIONS		L	T	P	C
21A040432			3	0	0	3
Pre-requisite	Analog Communications & Digital Communications	Semester	VII			

COURSE OBJECTIVES:

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To present impairments due to multipath fading channel, frequency management, Channel assignment and types of handoffs.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the characteristics of cellular systems **(K4)**

CO2: Apply the concepts of co-channel interference & Cell splitting to solve engineering problems **(K3)**

CO3: Analyze Co-channel and Non-Co-channel interferences **(K4)**

CO4: Explain frequency management and channel assignment **(K3)**

CO5: Evaluate suitability of a cellular system in real time applications **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	3	3	3
CO2	3	2	2	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	3	3	3
CO4	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	3	3	3

UNIT – I (10 Hrs)

Introduction to Cellular Mobile Radio Systems: Limitations of Conventional Mobile Telephone systems, Basic Cellular Mobile systems, Uniqueness of Mobile Radio Environment, Mobile Fading Characteristics, Operations of Cellular Systems, Evolution of Cellular Systems.

Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desire C/I from a normal case in a Omni Directional Antenna system, System capacity, Trunking and Grade of Service, Improving coverage and capacity in Cellular Systems – Cell Splitting, Sectoring, Mirocell Zone concept.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts and operation of cellular systems (L2).

- Understand the concept of frequency reuse and co-channel interference in cellular systems (L2).
- Analyze the characteristics of mobile radio environment (L4).

UNIT – II (8 Hrs)

Cell Coverage for Signal & Traffic: Signal Reflections in Flat and Hilly Terrain, Effect of Human Made Structures, Phase Difference between Direct & Reflected Paths, Constant Standard Deviations, Straight Line path loss, Slope, General Formula for Mobile Propagation over Water and Flat open area, Near and Long distance propagation, Path loss from a point to point prediction model in Different conditions, Merits of Lee Model.

Cell Site & Mobile Antennas: Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile antennas.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the concept of cellular systems & Mobile Antennas to solve engineering problems (L3).

UNIT – III (10 Hrs)

Co-Channel Interference Reduction: Measurement of Real time Co-Channel Interference, Design of Omni directional & Directional Antenna system, Antenna Parameters and Their Effects, Diversity Techniques- Space Diversity, Polarization Diversity, Frequency Diversity, Time Diversity.

Non-Co-Channel Interference: Adjacent Channel interference, Near End & Far End interference, Cross talk, Effects on coverage and interference by Power decrease, Antenna Height Decrease, Effects of Cell Site Components.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Co-Channel & Non Co-Channel interference (L2)
- Analyze concept of Omnidirectional & Directional antenna to solve engineering problems (L4).

UNIT – IV (8 Hrs)

Frequency Management & Channel Assignment: Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Site and Mobile Units, Channel Sharing and Borrowing, Overlaid Cells, Non Fixed Channel Assignment.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Numbering & Grouping (L2).
- Make use of concepts of Channel Sharing & Borrowing to solve engineering problems (L3).

UNIT – V (9 Hrs)

Handoffs and Dropped Calls: Handoff initiations, Types of Handoff, Delaying Handoff, Advantages of Handoff, Power difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoffs, Intersystem Handoff, Introduction to Dropped Call Rates and Evaluation.

System Evaluation: Performance Evaluation, Blockage, Dropped-call rate, Signaling Evaluation – False Alarm Rate, Word error rate consideration and calculations, Measurement of average received signal level and level crossings.

Learning Outcomes: At the end of this unit, students should be able to

- Compare various types of handoffs (L3).
- Compare various types of digital cellular systems (L3).
- Evaluate suitability of a cellular system in real time applications (L4).

TEXTBOOKS:

1. “Mobile Cellular Telecommunications”, William C. Y. Lee, 2nd Edition, McGraw-Hill International, 1995.
2. “Wireless Communications – Principles and Practice”, Theodore S. Rappaport, 2nd Edition, PHI, 2004.

REFERENCE BOOKS:

1. “Mobile Communication Engineering – Theory & Application”, W. C. Y. Lee, 2nd Edition, McGraw-HillInternational, 2014.
2. “Principles of Mobile Communications”, Gordon L. Stuber, Springer International, 2nd Edition 2001.
3. “Modern Wireless Communications”, Simon Haykin, Michael Moher, Pearson Education, 2005

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117102062
2. https://www.electronicshub.org/wireless-communication-introduction-types-applications/
3. https://en.wikipedia.org/wiki/Cellular_network

Course Code	BIOMEDICAL SIGNAL PROCESSING		L	T	P	C
21A040433			3	0	0	3
Pre-requisite	Digital Signal Processing	Semester	VII			

COURSE OBJECTIVES:

- To describe the origin, properties and suitable models of important biological signals
- To introduce students to basic signal processing techniques in analyzing biological signals.
- To develop a thorough understanding on basics of ECG signal compression algorithms.
- To increase awareness of the complexity of various biological phenomena and cultivate an understanding of the promises, challenges of the biomedical engineering.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the origin and properties of biomedical signals like ECG, EEG, EMG, PCG, EOG signals **(K3)**

CO2: Compare modern filtering and compression techniques required for biomedical signal processing **(K4)**

CO3: Analyze the nature of biomedical signals and related concepts, and event detection techniques for ECG signals **(K4)**

CO4: Analyze the nature of biomedical signals and related concepts, and event detection techniques for EEG and EMG signals **(K4)**

CO5: Develop an interest to simulate the models and validate its functionality in real time systems. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	3

UNIT – I (9 Hrs)

Preliminaries: Concept of Biological signals – Electrical, Mechanical, Chemical, Magnetic, Optical etc. Origin of electrical signal from Biological cell – Structure of Biological cell, Characteristics of Cell membrane, Distribution and movement of ions across the cell membrane, Generation of Biological cell Action Potential. Concept of Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Phonocardiogram (PCG), Electrooculogram (EOG), Respiratory signals etc.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the origin, properties of biomedical signals like ECG, EEG, PCG, ENG and EOG signals. (L2)
- Explain the structure and characteristics of various signals. (L3)

UNIT – II (9 Hrs)

Signal Conditioning: Band limiting of different Biological signals, Representation of biological signals in analog, discrete and digital forms. **Filtering for Removal of artifacts -** Statistical Preliminaries, Time domain filtering - Synchronized Averaging, Moving Average Filter to Integration, Derivative-based operator, **Frequency Domain Filtering** – FIR and IIR methods for implementing Notch, band selective filters, Weiner, Adaptive Filtering concepts.

Learning Outcomes: At the end of this unit, students should be able to

- Understand classical and modern filtering and compression techniques required for biomedical signal processing. (L2)
- Compare different filtering techniques. (L4)

UNIT – III (9 Hrs)

Electrocardiogram (ECG) Analysis: Concepts of morphological and rhythm analysis, Different types of arrhythmias, Derivative based Approaches for QRS Detection, Pan Tompkins Algorithm, Concepts of detecting the P, T waves, PR, ST intervals, QRS duration, etc. Heart Rate Variability (HRV) study and its importance.

Learning Outcomes: At the end of this unit, students should be able to

- Apply filters to remove noise, signal compression techniques & averaging technique on biomedical signals and extract the features of ECG signals. (L3)
- Analyze the nature of biomedical signals and related concepts, and event detection techniques for ECG signals (L4)

UNIT – IV (9 Hrs)

EEG, EMG signals Analysis: Basics of EEG and EMG signals. Signal strength, Signal entropy in time and frequency domain, Correlation coefficient, Envelop Extraction, Root Mean Square value, Zero-crossing rate, Form factor, Periodogram, Minimum phase correspondent, Power Spectral Density concepts in analyzing EEG and EMG signals.

Learning Outcomes: At the end of this unit, students should be able to

- Apply filters to remove noise, signal compression techniques and averaging technique on biomedical signals and extract the features of EEG and EMG signals. (L3)
- Analyze the nature of biomedical signals and related concepts, and event detection techniques for EEG and EMG signals. (L4)

UNIT – V (9 Hrs)

Modelling of Biomedical Systems: Motor unit firing pattern, Cardiac rhythm, Formants and pitch of speech, Point process, Parametric system modelling, Autoregressive model, Autocorrelation method, Application to random signals, Computation of model parameters, Levinson-Durbin algorithm, Computation of gain factor, Covariance method, Spectral matching and parameterization, Model order selection, Relation between AR and Cepstral coefficients, ARMA model, Sequential estimation of poles and zeros.

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate an ability to integrate different concepts to develop new models that suits current trends of Industries and analyze its performance. (L2)
- Develop an interest to simulate the models and validate its functionality in real time systems. (L4)

TEXTBOOKS:

1. “Biomedical Signal Analysis: A case Based Approach”, R M Rangayyan, IEEE Press, John Wiley & Sons. Inc, 2002.
2. “Biomedical Digital Signal Processing”, Willis J. Tompkins, EEE, PHI, 2004.
3. “Biomedical Signal Processing: Principles and Techniques”, D C Reddy, Tata McGraw-Hill Publishing Co. Ltd, 2005.

REFERENCE BOOKS:

1. “Signals and Systems in Biomedical Engineering: Physiological Systems Modeling and Signal Processing”, Suresh R Devasahayam, Springer, 3rd Edition, 2019.
2. “Medical Instrumentation: Application & Design”, J G Webster, John Wiley & Sons Inc., 2001.

Course Code	RADAR ENGINEERING		L	T	P	C
21A040434			3	0	0	3
Pre-requisite	Analog Communications	Semester	VII			

COURSE OBJECTIVES:

- To understand the Radar fundamentals and analysis of radar signals.
- To understand various technologies involved in the design of radar transmitters and receivers.
- To learn and compare MTI, Doppler and tracking radars.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the basic principle of radar and radar range equation. **(K3)**
CO2: Explain the working principle of various radar transmitters and receivers. (**K3**)
CO3: Distinguish between various radars like MTI, Doppler and tracking radar (**K3**)
CO4: Discriminate various Radar tracking techniques. (**K4**)
CO5: Analyze different beam formers and Matched Filter in Radar receivers (**K4**)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-

UNIT – I (10 Hrs)

BASICS OF RADAR: Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems.

RADAR EQUATION: SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Radar and its specifications (L2)
- Explain the Radar Equation. (L3)

UNIT – II (9 Hrs)

Continuous Wave (CW) RADAR: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems.

Frequency Modulated – CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Doppler effect to realise the CW and FM-CW radar. (L3)
- Analyse the receiver bandwidth requirements (L4).
- Distinguish between the stationary and moving targets (L4)

UNIT – III (9 Hrs)

MTI AND PULSE DOPPLER RADAR: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, and Staggered PRFs. Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the working of MTI radar. (L4)
- Understand the characteristics of delay line cancellers. (L3)
- Apply concept of staggered PRF to overcome blind spots in MTI Radar (L3)

UNIT – IV (9 Hrs)

TRACKING RADAR: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the design considerations of various tracking Radar techniques. (L2)
- Understand the operation of one and two coordinate Radar tracking techniques. (L2)
- Compare Radar tracking techniques (L4)

UNIT – V (8 Hrs)

DETECTION OF RADAR SIGNALS IN NOISE: Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

RADAR RECEIVERS: Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Series versus Parallel Feeds, Applications, Advantages and Limitations.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the characteristics of matched filters. (L4)
- Explain the operation of various radar receivers. (L3)

- Understand to locate the target with the help of radar displays. (L2)

TEXTBOOKS:

1. "Introduction to Radar Systems", Merrill I. Skolnik, TMH Special Indian Edition, 2nd Edition, 2007.

REFERENCE BOOKS:

1. "Introduction to Radar Systems", Merrill I. Skolnik, 3rd Edition, Tata McGraw-Hill, 2001.
2. "Radar Principles, Technology, Applications", Byron Edde, Pearson Education, 2004.
3. "Radar Principles", Peebles, Jr., P. Z. Wiley, New York, 1998

Course Code	DIGITAL IMAGE PROCESSING		L	T	P	C
21A040435			3	0	0	3
Pre-requisite	Signals and systems	Semester	VII			

COURSE OBJECTIVES:

- To introduce fundamentals of Image Processing.
- To know about various techniques of image enhancement and reconstruction.
- To teach various color models and color image enhancement
- To dissimilate various segmentation techniques for images.
- To impart concepts of various coding techniques for image compression.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various types of images mathematically. **(K4)**
CO2: Analyze images in the frequency domain using various transforms. **(K4)**
CO3: Compare image enhancement methods in spatial and frequency domains. **(K3)**
CO4: Apply various segmentation and restoration algorithms for processing an image. **(K3)**
CO5: Categorize various compression techniques and color models. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO4	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighbourhood, adjacency, connectivity, distance measures. Mathematical tools/ operations applied on images.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic building blocks of image processing. (L2)
- Define image processing parameters such as adjacency and distance measures. (L1)
- Analyze various types of images mathematically. (L4)

UNIT – II (9 Hrs)

Image transforms: 2D Orthogonal and Unitary Transforms and their properties - Fast Algorithms - Discrete Fourier Transform - Discrete Cosine Transforms- Walsh- Hadamard Transforms, Hoteling Transforms, Comparison of properties of the above.

Learning Outcomes: At the end of this unit, students should be able to

- Apply various image transforms for converting spatial domain into frequency domain (L3)
- Compare various properties of image transformation techniques(L4)

UNIT – III (9 Hrs)

Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, frequency domain filters – low-pass and high-pass.

Learning Outcomes: At the end of this unit, students should be able to

- Apply spatial domain and frequency Domain filtering techniques for image enhancement (L3)
- Compare image enhancement methods in spatial and frequency domains (L2)

UNIT – IV (9 Hrs)

Image Restoration: Degradation model, Algebraic approach to restoration – Inverse filtering – Least Mean Square filters, Constrained Least square restoration, Blind Deconvolution.

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Apply various segmentation and restoration algorithms for processing an image. (L3)
- Illustrate detection of discontinuities in an image (L2)

UNIT – V (9 Hrs)

Image Compression: Redundancies in Images, Compression models, Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Transform coding, Still image compression standards – JPEG and JPEG-2000.

Color Image Processing: Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image enhancement.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the need for compression (L2)
- Categorize various techniques of compression (L4)
- Categorize various color models for color image processing (L4)

TEXTBOOKS:

1. "Digital Image Processing", R.C. Gonzalez and R.E. Woods, Pearson Education, 2nd Edition, 2008.
2. "Fundamentals of Digital Image Processing", Anil Kumar Jain, Prentice Hall of India, 2nd Edition 2004.

REFERENCE BOOKS:

1. "Digital Image processing using MATLAB", Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Tata McGraw Hill, 2010.
2. "Image Processing, Analysis, and Machine Vision", Milan Sonka, Vaclav Hlavac, Roger Boule, Cengage Learning, 3rd Edition, 2016.
3. "Digital Image processing", S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.
4. "Digital Image Processing", William K. Pratt, John Wiley, 3rd Edition, 2004.

ONLINE LEARNING RESOURCES:

1. https://www.udemy.com/course/learn-image-analysis/
2. https://alison.com/tag/image-processing
3. https://nptel.ac.in/courses/117/105/117105135/

Course Code	ADVANCED MICROPROCESSORS		L	T	P	C
21A040436			3	0	0	3
Pre-requisite	Microprocessors and Microcontrollers	Semester	VII			

COURSE OBJECTIVES:

- To study the programming model and architectures of advanced processors
- To understand the architectural features of the 80386, 80486, Pentium processors.
- To learn about the protected mode software model of the 80386 including segmentation, protection, paging and multitasking.
- To understand the need and features of arithmetic coprocessor

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the architecture and features of advanced microprocessors **(K3)**
CO2: Discuss the architectural features and memory management of 80386 and 80486 processors **(K3)**
CO3: Explain the features of Pentium and Pentium pro processors **(K3)**
CO4: Describe the features of Pentium II, Pentium III, Pentium 4 and Core2 processors **(K3)**
CO5: Explain the internal structure of 80x87 arithmetic coprocessor and its features **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	3

UNIT – I (9 Hrs)

The Microprocessor and its architecture: The programming model, multipurpose registers, real mode memory addressing, segments and offsets, protected mode memory addressing, selectors and descriptors, memory paging, the page directory and page table, pipelining, pipeline hazards, instruction level parallelism, Reduced Instruction Set Computer principles, RISC versus CISC.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the programming model and registers of 80x86 processor (L2)
- Explain the memory segmentation, virtual memory and paging mechanism (L3)
- Explain RISC and CISC processor architectures (L3)

UNIT – II (9 Hrs)

The 80386 and 80486 microprocessors: Salient features and architecture of the 80386, memory system of the 80386, special 80386 registers, memory management, protected virtual addressing, virtual 8086 mode, the memory paging Mechanism, Salient features and architecture of the 80486 microprocessor.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the features of 80386 and 80486 microprocessors (L3)
- Explain the memory management of 80386/80486? (L3)
- Describe the protected mode and virtual 8086 mode of 80386 (L2)

UNIT – III (9 Hrs)

The Pentium and Pentium Pro microprocessors:

Pentium CPU Architecture, Superscalar organization, Pipelining, memory system, branch predication, floating point unit, special Pentium registers, Pentium memory management, new Pentium instructions, Pentium pro architecture and features

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the features of Pentium and Pentium pro microprocessors (L3)
- Explain the memory management of Pentium processor (L3)
- Describe about the branch prediction logic in Pentium processor (L2)

UNIT – IV (9 Hrs)

The Pentium II, Pentium III, Pentium IV and Core 2 microprocessors

Introduction to the Pentium II, memory map of Pentium II based computer system, Pentium II software changes, salient features of Pentium III, Pentium 4 and Core2 microprocessors, multiple core technology, hyper-threading technology, model specific registers, performance monitoring registers, 64-bit extension technology

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the features of Pentium II, Pentium III, Pentium 4 and Core2 microprocessors (L3)
- Describe the multiple core technology and hyper-threading technology (L2)
- Explain the model specific registers and performance monitoring registers (L3)

UNIT – V (9 Hrs)

Arithmetic Coprocessor, MMX and SSE technologies: Data formals for the arithmetic Coprocessor, Internal Structure of 8087 and Advanced Coprocessors, MMX and SSE Technologies, Instruction Set (brief treatment).

Learning Outcomes: At the end of this unit, students should be able to

- Describe the data formats for arithmetic coprocessor (L2)
- Explain the internal structure of 8087 arithmetic coprocessor (L3)
- Discuss about MMX and SSE technologies (L3)

TEXTBOOKS:

1. "The Intel Microprocessors", Barry, B. Brey, Pearson Education, 8th Edition, 2009.
2. "Advanced Microprocessor and Peripherals", A.K. Ray and K.M. Bhurchandi, TMH.
3. "Advanced Microprocessors", Daniel Tabak, McGraw Hill. Inc., 1995

REFERENCE BOOKS:

1. "The Pentium Microprocessor", James L. Antonakos, Pearson Education , 1997.
2. "Micro Computer Engineering", Gene .H. Miller, Pearson Education , 2003.
3. "Microprocessors and Interfacing", Douglas V. Hall, Special Indian Edition, 2006

Course Code	NANO ELECTRONICS		L	T	P	C
21A040437			3	0	0	3
Pre-requisite	Applied Chemistry, Electronic Devices and Circuits	Semester	VII			

COURSE OBJECTIVES:

- To choose different models of MOS devices according to the requirement.
- To teach nano electronic systems and its building blocks
- To provide knowledge on spin electronic devices.
- To familiarize students with the present research trend in Nano electronics.
- To compare MOSFET, CNFET and Spin FET devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the limitations of scaling down oxide layer to below 100nm. **(K3)**
CO2: Analyse MOSFETS with different gate structures. **(K4)**
CO3: Model the device with basic quantum structures. **(K3)**
CO4: Analyse different hetero structures. **(K4)**
CO5: Discuss various carbon nano tube FETS. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	-	-	-	-	-	-	-	3	-	3
CO2	3	2	-	2	-	-	-	-	-	-	-	3	1	3
CO3	3	2	2	2	-	-	-	-	-	-	-	3	1	3
CO4	3	2	2	2	-	-	-	-	-	-	-	3	1	3
CO5	3	2	2	2	-	-	-	-	-	-	-	3	1	3

UNIT – I (9 Hrs)

Challenges going to sub-100 nm MOSFETs Oxide layer thickness, tunneling, power density, non-uniform dopant concentration, threshold voltage scaling, lithography, hot electron effects, sub-threshold current, velocity saturation, interconnect issues, fundamental limits for MOS operation.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the challenges in scaling down oxide layer. (L2)
- Understand the fundamental limits of MOS operation. (L2)
- Effect on MOS operation due to different parametric changes. (L3)

UNIT – II (9 Hrs)

Novel MOS-based devices Multiple gate MOSFETs, Silicon-on-insulator, Silicon-on-nothing, Fin FETs, vertical MOSFETs, strained Si devices.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the operation of different gate structure transistors. (L2)
- Compare different MOSFET transistors. (L3)
- Identify the transistors suitable for different applications. (L2)

UNIT – III (9 Hrs)

Quantum structures quantum wells, quantum wires and quantum dots, Single electron devices charge quantization, energy quantization, Coulomb blockade, Coulomb staircase, Bloch oscillations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of quantum structures. (L2)
- Model the devices using quantum structures. (L3)

UNIT – IV (9 Hrs)

Hetero structure based devices Type I, II and III hetero junctions, Si-Ge hetero structure, hetero structures of III-V and II-VI compounds - resonant tunneling devices.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of different compound structures. (L2)
- Compare different hetero structures. (L3)

UNIT – V (9 Hrs)

Carbon nano tubes based devices CNFET, characteristics; Spin-based devices spin FET, characteristics, Applications of MOSFET, CNFET and Spin FET devices.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire the knowledge on different CNT devices. (L2)
- Compare CNFET and spin FET devices. (L3)

TEXTBOOKS:

1. "Nano electronics Principles & devices", Mircea Dragoman and Daniela Dragoman, Artech House Publishers, 2005.
2. "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices", Karl Goser, Springer 2005.

REFERENCE BOOKS:

1. "Nanoscale Transistors: Device Physics Modelling and Simulation", Mark Lundstrom and Jing Guo, Springer, 2005.
2. "Quantum hetero structures", Vladimir V Mitin, Viatcheslav A Kochelap and Michael A Stroscio, Cambridge University Press, 1999.
3. "High speed semiconductor devices", S M Sze (Ed), Wiley, 1990.

Course Code	MANAGEMENT SCIENCE (Common to all Branches)		L	T	P	C
21A110204			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training& Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concepts and principles of management in real life industry design and develop organization chart and structure for an enterprise. **(K3)**

CO2: Apply operations management techniques in real life industry. **(K3)**

CO3: Apply the concepts of HRM in Recruitment, Selection, Training & Development. **(K3)**

CO4: Develop PERT/CPM charts for projects of an enterprise and estimate time & cost of a project and to develop Mission, Objectives, Goals & Strategies for an enterprise in dynamic environment. **(K3)**

CO5: Understand & apply modern management techniques wherever possible. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	3	-	-	-

UNIT – I (9 Hrs)

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of management and organization (L2)

- Apply the concepts & principles of management in real life industry (L3)
- Analyze the organization chart & structure for an enterprise.(L4)
- Evaluate and interpret the theories and the modern organization theory (L5)

UNIT – II (10 Hrs)

Operations Management: Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the core concepts of Management Science and Operations Management (L2)
- Apply the knowledge of Quality Control, Work-study principles in real life industry (L3)
- Evaluate Materials departments & Determine EOQ (L5)
- Analyze Marketing Mix Strategies for an enterprise (L4)
- Create and design advertising and sales promotion (L5)

UNIT – III (6 Hrs)

HUMAN RESOURCES MANAGEMENT: HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development (L2)
- Apply Managerial and Operative Functions (L3)
- Analyze the need of training (L4)
- Evaluate performance appraisal (L5)
- Design the basic structure of salaries and wages (L5)

UNIT – IV (12 Hrs)

Strategic & Project Management: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme

Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

Learning Outcomes: At the end of this unit, students should be able to

- Understand Mission, Objectives, Goals & Strategies for an enterprise (L2)
- Apply SWOT Analysis to strengthen the project (L3)
- Analyze Strategy formulation and implementation (L4)
- Evaluate PERT and CPM Techniques (L5)
- Create in competing the projects within given time (L5)

UNIT – V (8 Hrs)

Contemporary Issues in Management: The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand modern management techniques (L2)
- Apply Knowledge in modern management (L3)
- Analyze CRM, TQM (L4)
- Evaluate Six Sigma concept and SCM (L5)

TEXTBOOKS:

1. “Management Science”, A.R Aryasri, TMH, 2013
2. “Management”, Stoner, Freeman, Gilbert, Pearson Education, New Delhi, 2012.

REFERENCE BOOKS:

1. “Essentials of Management”, Koontz &Weihrich, TMH, 6th Edition, 2005.
2. “Management Principles and Guidelines”, Thomas N. Duening & John M. Ivancevich, Biztantra.
3. “Production and Operations Management”, Kanishka Bedi, Oxford University Press, 2004.
4. “Modern Management”, Samuel C. Certo, 9th Edition, PHI, 2005

Course Code	**SOFTWARE TESTING TOOLS**		**L**	**T**	**P**	**C**
21A050707			**1**	**0**	**2**	**2**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand what is testing? and Software development model.
- To describe different approaches to Testing and testing methodologies.
- To demonstrate how to write and execute test plans
- To illustrate the basic concepts of automation testing
- To discuss about Test NG and other important concepts in automation testing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic concepts of testing and SDLC Models. **(K2)**
CO2: Examine STLC and different types of testing and defects. **(K3)**
CO3: Analyze automation testing and its elements and time functions. **(K4)**
CO4: Demonstrate different Popups in automation testing. **(K3)**
CO5: Analyze various Test NG Frameworks. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

MODULE – I:

Manual Testing: Introduction, Error, Defect, Bug, Verification, Validation. Testing: Types of Testing, White box and Black box Testing. Software Development Life Cycle : Introduction to Software Development Life Cycle, Models for SDLC, Metrics for Projects.

MODULE – II:

Software Testing Life Cycle: Basic Concepts, Testing Methodologies, Test Plans, Test Cases, Test Executions and Defect Reports. **Defects:** Types of Defects, Defect Life Cycle, Levels vs Builds, Priority and Severity. **Types of Testing:** Functionality Testing, Security Testing, Smoke Testing, Sanity Testing, Adhoc Testing, Exploratory Testing, Load Testing, Stress Testing, Regression Testing, Retesting.

MODULE – III:

Automation Testing: Introduction to Selenium, Components in Selenium, Installation Process, Cross Browser, Parallel Testing, Web Driver Methods and Locators. **Working on the Elements:** Links, Dropdown, Radio Buttons, Check Boxes, Web Tables, Actions. **Time Functions:** Implicit, Explicit, Page Load Functions, Scroll Functions.

MODULE – IV:

Working on Popups: Alerts, Prompts, Confirmation, Working on Frames and Windows, Introduction to Test NG Designs, Annotations in TestNG. Apache POI Jar Files 3.17 for Reading, Writing Excel Files. Page Object Model-Property List.

MODULE – V:

Test NG Frameworks: Framework Designing Structure, Keyword Framework, Data Driven Framework, Linear Framework, Modular Framework, Hybrid Framework. Working on Maven Project – Creating Extent Reports, Basics of Github and Jenkins.

LIST OF EXPERIMENTS:

Week 1 :

Write a ‘C’ program to demonstrate the working of the following constructs:

a). do…while
b). while
c). if …else
d). switch
e). for Loops in C language.

Week 2 :

A program written in c language for matrix multiplication fails “Introspect the causes for its failure and write down the possible reasons for its failure”.

Week 3 :

A) Take any system (e.g. ATM system) and study its system specifications and report the various bugs.

B) Write the test cases for any known application (e.g. Banking application)

C) Create a test plan document for any application (e.g. Library Management System.

Week 4 :

Write a script to open google.com and verify that title is Google and also verify that it is redirected to google.co.in

Week 5 :
Write a script to open google.co.in using chrome browser (ChromeDriver).

Week 6 :
Write a script to open google.co.in using internet explorer (InternetExplorerDriver).

Week 7 :
Write a script to login Next Generation Automation.

Week 8 :
Write a script to close all the browsers without using quit() method.

Week 9 :
Write a script to test the Gmail Login & Logout procedure .

Week 10 :
Write a script to test the Facebook Account Creation .

Week 11 :
Write a script to test the Google Cache Selection.

Week 12 :
Write a script to test the Gmail Composing Dynamically.

REFERENCE BOOKS:

1. “Software Testing: Principles and Practices”, Srinivasan Desikan, Gopalaswamy Ramesh, 1st Edition, Pearson Education.
2. “Software Testing: Principles and Practices”, Naresh Chauhan, 2nd Edition, Oxford University Press
3. “Java Complete Reference”, Herb Schildt, 9th Edition , Oracle press.

OPEN ELECTIVE – I

Course Code	AIR POLLUTION AND CONTROL		L	T	P	C
21A010501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To identify the sources of air pollution
- To know the composition and structure of atmosphere
- To know the pollutants dispersion models
- To understand the working of air pollution control equipment
- To identify the sources of noise pollution and their controlling methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the sources of air pollution. **(K2)**

CO2: Explain the composition and structure of atmosphere. **(K4)**

CO3: Discuss the general characteristics of stack emissions and their behavior. **(K2)**

CO4: Understand the mechanism of Control of air pollutants. **(K2)**

CO5: Know about the noise sources, mapping, prediction equations etc. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	-	-	-	3	1	-	-	-	-	3	1
CO2	3	1	3	-	-	-	3	1	-	-	-	-	1	1
CO3	3	2	2	-	-	-	3	1	-	-	-	-	2	2
CO4	3	1	2	-	-	-	3	1	-	-	-	-	1	1
CO5	3	2	2	-	-	-	3	1	-	-	-	-	1	2

UNIT – I (9 Hrs)

Introduction: sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance. Indoor Air Pollution– sources, effects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the character of atmospheric pollutants and their effect. (L4)

UNIT – II (9 Hrs)

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Wind rose diagram.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the composition and structure of atmosphere. (L4)
- Write the maximum mixing depth and windrose diagram. (L6)

UNIT – III (9 Hrs)

General characteristics of stack emissions, plume behavior, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources. Monitoring of particulate matter and gaseous pollutants –respirable, non-respirable and nano - particulate matter. CO, CO2, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

Learning Outcomes: At the end of this unit, students should be able to

- Express about the general characteristics of stack emissions and their behavior. (L6)
- Analyze the monitoring of particulate matter and gaseous pollutants. (L4)

UNIT – IV (9 Hrs)

Air Pollution Control equipment for particulate matter & gaseous pollutants– gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – Adsorption, Absorption, Scrubbers, Condensation and Combustion.

Learning Outcomes: At the end of this unit, student should be able to

- Explain the various air pollution control equipment. (L3)

UNIT – V (9 Hrs)

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the noise sources, mapping, prediction equations etc., (L5)

TEXTBOOKS:

1. “Air Pollution - Its Origin and Control”, Wark K., Warner C.F., and Davis W.T, Harper & Row Publishers, New York.
2. “Environmental Engineering”, H.S. Peavy, D.R. Row & G. Tchobanoglous, Mc Graw Hill International Edition

REFERENCE BOOKS:

1. “Air Pollution”, Perkins H.C., McGraw Hill.
2. “Air Pollution Control Theory”, Crawford M., TATA McGraw Hill.
3. “Air Pollution”, Stern A.C., Volume I, II, III.
4. “Air Pollution”, Seinfeld N.J., McGraw Hill.
5. “Air Quality Management”, Stern A.C., Volume V.
6. “Air Pollution”, M N Rao and HVN Rao, Tata McGraw Hill publication

ONLINE LEARNING RESOURCES:

1. http://www.epa.gov
2. http://www.indiaenvironmentportal.org.in
3. http://nptel.iitm.ac.in
4. http://www.filtersource.com

Course Code	ELECTRIC VEHICLES		L	T	P	C
21A020501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- Get exposed to EV system configuration and parameters
- Know about electro mobility and environmental issues of EVs
- Understand about basic EV propulsion and dynamics
- Understand about fuel cell technologies for EV and HEVs
- Know about basic battery charging and control strategies used in electric vehicles

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand and differentiate between conventional and latest trends in Electric vehicles. **(K2)**

CO2: Analyze various EV resources, EV dynamics and Battery charging. **(K4)**

CO3: Apply basic concepts of EV to design complete EV system. **(K3)**

CO4: Design EV system with various fundamental concepts. **(K5)**

CO5: Analyze the various control strategies used in battery charging in the electric vehicles. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to EV Systems and Parameters: Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic concepts of EV to design complete EV system. (L3)
- Explain EV system configuration. (L3)
- Understand various EV parameters. (L2)

UNIT – II (9 Hrs)

EV and Energy Sources: Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand electro mobility and environmental issues of EVs. (L2)
- Explain the history of Electric power trains. (L3)
- Compare conventional, battery, hybrid and fuel cell electric systems. (L3)

UNIT – III (9 Hrs)

EV Propulsion and Dynamics: Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi-motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of EV system. (L2)
- Choose a suitable electric propulsion system. (L2)
- Classify EV motors and their applications. (L3)

UNIT – IV (9 Hrs)

Fuel Cells: Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples.

Learning Outcomes: At the end of this unit, students should be able to

- FUEL CELLS: Explain the working principle of Fuel cells. (L3)
- Analyze fuel cell technologies for EV and HEVs. (L4)
- Compare series, series-parallel hybrid systems. (L3)

UNIT – V (9 Hrs)

Battery Charging and Control: Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modeling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic battery charging in Electric Vehicles. (L2)
- Analyze control strategies used in electric vehicles. (L4)

TEXTBOOKS:

1. "Modern Electric Vehicle Technology", C.C Chan, K.T Chau, Oxford University Press Inc., New York 2001.

2. “Electric Vehicle Technology Explained”, James Larmenier, John Lowry, Wiley, 2003.

REFERENCE BOOKS:

1. “Electric and Hybrid Vehicles Design Fundamentals”, Iqbal Husain, CRC Press 2005.
2. “Advanced Electric Drive Vehicles”, Ali Emadi, CRC Press, 2015.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

Course Code	ELECTRICAL DISTRIBUTION SYSTEMS		L	T	P	C
21A020502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- The classification of distribution systems
- The aspects and design considerations in DC and AC distribution and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the various factors associated with power distribution. **(K3)**
CO2: Make voltage drop calculations in given distribution networks. **(K3)**
CO3: Learn principles of substation maintenance. **(K2)**
CO4: Compute power factor improvement for a given system and load. **(K3)**
CO5: Understand implementation of SCADA for distribution automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Load Modeling and Characteristics: Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural, and Industrial) and Their Characteristics.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic concepts of the electrical distribution systems. (L2)
- Analyze the relationship between load factor and loss factor. (L4)
- Understand the various loads and its characteristics. (L2)

UNIT – II (9 Hrs)

Classification Of Distribution Systems: Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop

Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the classification of electrical distribution systems. (L2)
- Analyze the design considerations of the radial and loop type feeders. (L4)

<u>UNIT – III</u> (9 Hrs)

Substations: Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar Sectionalized Single Bus Bar, With Relevant Diagrams.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the layout of the substation and various equipment installed. (L2)
- Analyze the classification of the substation based on insulating medium. (L4)
- Understand various bus bar schemes in substation. (L2)

<u>UNIT – IV</u> (9 Hrs)

Power Factor Improvement: Three Phase Balanced Primary Lines. Causes of Low P.F - Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

<u>UNIT – V</u> (9 Hrs)

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Learning Outcomes: At the end of the unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

TEXTBOOKS:

1. "Electric Power Distribution Engineering", Turan Gonen, CRC Press, 3rd Edition, 2014.
2. "Electric Power Distribution", A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

REFERENCE BOOKS:

1. "Electric Power Distribution Automation", Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010
2. "Electrical Power Distribution Systems", V. Kamaraju, Jain Book Depot, 2012.

Course Code	ROBOTICS		L	T	P	C
21A030501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control
- To choose and incorporate robotic technology in engineering systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the introduction and types of robots. **(K2)**
CO2: Analyze kinematics using forward and inverse kinematics and dynamics of robots using transformation, Jacobians, Lagrange – Euler and Newton – Euler formation. **(K4)**
CO3: Understand the working principle of different types of actuators and sensors. **(K2)**
CO4: Understand the motion types and robot programming software. **(K2)**
CO5: Know importance of robotic Applications in manufacturing. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	1	-	-	-	-	-	-	2	3	-
CO2	1	-	3	-	-	-	-	-	-	-	-	1	1	3
CO3	3	-	2	-	2	-	-	-	-	-	-	1	3	1
CO4	3	-	2	-	3	-	-	-	-	2	-	-	3	2
CO5	3	-	2	-	2	-	-	-	-	1	-	2	3	-

UNIT – I (8 Hrs)

Introduction to Industrial Robots: Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of robots. (L2)
- Differentiate types of robots and robot grippers. (L4)

UNIT – II (8 Hrs)

Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation-D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformation, Jacobians .Lagrange – Euler and Newton – Euler formations.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire the knowledge about robot kinematics and dynamics. (L2)
- Analyze the forward and inverse kinematics of robot manipulators. (L4)

UNIT – III (9 Hrs)

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile sensors, Proximity sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the various types of robot actuators and feedback components. (L1)
- Understand the working of robot sensors. (L2)

UNIT – IV (11 Hrs)

Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion.

Robot programming - Types – features of languages and software packages.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze motion in links and joints of a robot. (L4)
- Understand the types and software packages of robots. (L2)

UNIT – V (9 Hrs)

Robot Application in Manufacturing: Material Transfer -Material handling, loading and unloading - Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Learning Outcomes: At the end of this unit, students should be able to

- Express the various applications of robots in industries. (L2)
- Acquire the knowledge about real time applications of robots in manufacturing. (L2)

TEXTBOOKS:

1. "Industrial Robotics", M.P. Groover, TMH.
2. "Robotics, Fundamental Concepts and analysis", Ashitave Ghosal, Oxford Press
3. "Robotics and Control", Mittal R K & Nagrath I J, TMH.

REFERENCE BOOKS:

1. "Robotics", Fu K S, McGraw Hill.
2. "An Introduction to Robot Technology", P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. "Robotic Engineering", Richard D. Klafter, Prentice Hall
4. "Introduction to Robotics", John J. Craig, Pearson Edu
5. "Automation, Production systems and CIM", M.P. Groover, Pearson Edu

Course Code	BASICS OF MECHANICAL ENGINEERING		L	T	P	C
21A030502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize students with basic power plants types, turbines, pumps, IC engines, boilers, refrigeration and air conditioning process and their performance aspects.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know types of power generating plants by using conventional or Non-conventional resources. **(K2)**

CO2: Understand and implementation of turbines, explain different types of pumps and their application. **(K2)**

CO3: Describe To familiarize the developments in IC engines. **(K2)**

CO4: Uunderstand the concept of the boilers. **(K2)**

CO5: Explain the working principles of refrigeration and air conditioning systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	2	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-	-	2	-	-

UNIT – I (10 Hrs)

Power Plant Engineering: Introduction – Energy Renewable and Non – Renewable Energy, Sources – Classification of Power Plants based on Sources of Energy – Thermal Power Plant or Steam Power Plant – Hydro Electric Power – Nuclear Fission, Chain Reaction, Layout of Nuclear Power Plant – Diesel Power Plant – Gas Turbine Power Plant – Open Cycle Gas Turbine, Closed Cycle Gas Turbine Power Plant, Comparison of Diesel Power Plant with Gas Turbine Power Plant.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the energy Renewable and Non – Renewable Energy Sources. (L2)
- Illustrate the working principle of Steam, Nuclear & open cycle, and closed cycle gas turbine. (L2)

UNIT – II (10 Hrs)

Hydraulic Turbine – Classification of Hydraulic Turbines, Impulse Turbine, Reaction Turbine, Difference between Impulse and Reaction Turbine.

Pumps – Classification of Pumps, Centrifugal Pump, Applications of Centrifugal Pump, Priming, Reciprocating Pumps, Single Acting Reciprocating Pump, Working of a Double acting Reciprocating Pump, Comparison of Reciprocating Pump with Centrifugal Pump.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Hydraulic Turbines, Impulse Turbine, and Reaction Turbine. (L2)
- Understand the working of Centrifugal Pump, Reciprocating Pumps and Comparison between them. (L2)

<u>UNIT – III</u> (10 Hrs)

I.C Engine: Heat Engine – Types of Heat Engine – External Combustion Engine, IC Engine (Internal Combustion), Classification of I.C. Engine, Two Stroke Petrol Engine, Four Stroke Engine, Valve Timing Diagram, Port Timing Diagram, Comparison of Two Stroke and Four Stroke Engines, Comparison of Petrol Engine and Diesel Engine, Fuel System of a Petrol Engine, Ignition Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of External Combustion Engine, IC Engine. (L2)
- Illustrate the working of Two Stroke Petrol Engine, Four Stroke Engine. (L2)

<u>UNIT – IV</u> (7 Hrs)

Boilers: Classification of Boilers – Simple Vertical Boiler – Cochran Boiler – Babcock and Wilcox Boiler – Benson Boiler – Difference between Fire Tube and Water Tube Boilers – Boiler Mountings – Boiler Accessories – Difference between Boiler Mountings and Accessories.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of different types Fire Tube and Water Tube Boilers.(L2)

<u>UNIT – V</u> (8 Hrs)

Refrigeration and Air Conditioning: Introduction – Terminology of Refrigeration and Air Conditioning – Properties of Refrigerants – List of Commonly used Refrigerants – Types of Refrigerating System – Vapour Compression Refrigeration System – Vapour Absorption Refrigerator – Domestic Refrigerator – Air Conditioning – Application of Air Conditioning – Psychrometry – Window Air Conditioning.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Vapour Compression Refrigeration System – Vapour Absorption Refrigeration system. (L2)
- Illustrate the working of Air Conditioning. (L2)

TEXTBOOKS:

1. "Basic Civil and Mechanical Engineering", Er. R. Vaishnavi, Prof. V. Vijayan, Prof. M. Prabhakaran, S. Chand Publication, 2nd Edition
2. "Elements of Mechanical Engineering", S Trymbaka Murthy, University Press, 4th Edition

REFERENCE BOOKS:

1. "Elements of Mechanical Engineering", S. N. Lal, Cengage Learning, 2013
2. "Elements of Mechanical Engineering", S. Trymbaka Murthy, Universities Press, 2015
3. "Mechanical Technology", Dr M. Maruthi Rao and V. Pavan Kumar, Lambert Academic Publishing, 2022

Course Code	OPERATING SYSTEMS CONCEPTS		L	T	P	C
21A050501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To gain knowledge about the Operating Systems concepts such as process, main memory management, secondary memory management, CPU and disk scheduling etc.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the general architecture of computers **(K2)**

CO2: Describe, contrast and compare differing structures for operating Systems. **(K3)**

CO3: Analyse theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files. **(K4)**

CO4: Understand paging mechanism, virtual memory **(K2)**

CO5: Understand and identify the dead lock and methods to recovery the dead lock **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	2	1	-	-	-	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-	-	-
CO4	3	2	2	2	-	2	-	-	2	-	-	-	-	1
CO5	3	2	2	2	-	2	-	-	2	-	-	-	-	1

UNIT – I (9 Hrs)

Computer System and Operating System Overview: Overview of computer operating systems, operating systems functions, protection and security, distributed systems, special purpose systems, operating systems structures and systems calls, operating systems generation.

Learning Outcomes: At the end of this unit, students should be able to

- Identify major components of operating systems. (L1)
- Understand the types of computing environments. (L2)
- Explore several open-source operating systems. (L4)
- Recognize operating system services to users, processes and other systems. (L2)

UNIT – II (10 Hrs)

Process Management – Process concept- process scheduling, operations, Inter process communication. Multi Thread programming models. Process scheduling criteria and algorithms, and their evaluation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance, features of a process and methods of communication between processes. (L2)
- Examine CPU utilization through multi programming and multithreaded programming. (L3)

UNIT – III (8 Hrs)

Concurrency: Process synchronization, the critical- section problem, Peterson's Solution, synchronization Hardware, semaphores, classic problems of synchronization, monitors, Synchronization examples.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the various Problems of Process Synchronization. (L3)

UNIT – IV (8 Hrs)

Memory Management: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation Virtual Memory Management: virtual memory, demand paging, page-Replacement, algorithms, Allocation of Frames, Thrashing.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the various techniques of allocating memory to processes. (L3)
- Summarize how paging works in contemporary computer systems. (L4)
- Understanding the benefits of virtual memory systems. (L2)

UNIT – V (10 Hrs)

Principles of deadlock– system model, deadlock characterization, deadlock prevention, detection and avoidance, recovery form deadlock.

Learning Outcomes: At the end of this unit, students should be able to

- Investigate methods for preventing/avoiding deadlocks. (L4)
- Examine file systems and its interface in various operating systems. (L3)

TEXTBOOKS:

1. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, John Wiley, 7th Edition.
2. "Operating Systems – Internal and Design Principles", Stallings, Pearson education, 6th Edition, 2005.

REFERENCE BOOKS:

1. "Operating systems- A Concept based Approach", D. M. Dhamdhere, 2nd Edition, Tata McGraw Hill
2. "Operating System – A Design Approach", Crowley, TMH.

3. "Modern Operating Systems", Andrew S Tanenbaum, 3rd Edition, Prentice Hall International.

ONLINE LEARNING RESOURCES:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/Operating%20Systems/New_index1.html

Course Code	COMPUTER ARCHITECTURE & ORGANIZATION		L	T	P	C
21A050502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Principles and the Implementation of Computer Arithmetic
- Operation of CPUs including RTL, ALU, Instruction Cycle and Busses
- Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design
- Memory System and I/O Organization
- Principles of Operation of Multiprocessor Systems and Pipelining.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop a detailed understanding of computer systems **(K4)**

CO2: Cite different number systems, binary addition and subtraction, standard, floating-point, and micro-operations **(K3)**

CO3: Develop a detailed understanding of architecture and functionality of central processing unit **(K4)**

CO4: Exemplify in a better way the I/O and memory organization **(K3)**

CO5: Illustrate concepts of parallel processing, pipelining and inter processor communication. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating, Point Representation. Other Binary Codes, Error Detection Codes. Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Organization of Computers. (L2)
- Compare various Arithmetic Algorithms. (L5)

UNIT – II (10 Hrs)

Register Transfer Language and Micro operations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift

Micro Operations, Arithmetic Logic Shift Unit. Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description.

Learning Outcomes: At the end of this unit, students should be able to

- Perform various functions using basic logical operations. (L5)
- Apply I/O and interrupts to execute various operations. (L4)

UNIT – III (8 Hrs)

Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Micro programmed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various addressing Modes. (L1)
- Compare various instruction formats. (L5)
- Design and other issues related to Control Unit. (L4)

UNIT – IV (8 Hrs)

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.

Learning Outcomes: At the end of this unit, students should be able to

- Compare various memories. (L3)
- Analyze various modes of transfer. (L5)

UNIT – V (8 Hrs)

Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration.

Pipeline: Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

Learning Outcomes: At the end of this unit, students should be able to

- Analyzing various processors. (L5)
- Compare various Pipeline. (L4)

TEXTBOOKS:

1. "Computer System Architecture", M. Morris Mano, Pearson, 3rd Edition, 2008.
2. "Computer Organization", Carl Hamacher, Zvonko Vranesic, Safwat Zaky, McGraw Hill, 5th Edition, 2002.

REFERENCE BOOKS:

1. "Computer Organization and Architecture", William Stallings, Pearson, 6th Edition, 2006.
2. "Structured Computer Organization", Andrew S. Tanenbaum, Pearson, 4th Edition, 2005.
3. "Fundamentals of Computer Organization and Design", Sivarama P. Dandamudi, Springer, 2006.

ONLINE LEARNING RESOURCES:

1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

OPEN ELECTIVE – II

Course Code	ENVIRONMENTAL POLLUTION AND CONTROL		L	T	P	C
21A010502			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart knowledge on aspects of air pollution & control and noise pollution.
- To impart concepts of treatment of waste water from industrial source.
- To differentiate the solid and hazardous waste based on characterization.
- To introduce sanitation methods essential for protection of community health.
- To provide basic knowledge on sustainable development.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the fundamentals of solid waste management, practices adopted in his town / village and its importance in keeping the health of the city. **(K2)**

CO2: Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards**. (K2)**

CO3: Differentiate the treatment techniques used for sewage and industrial wastewater Treatment. **(K3)**

CO4: Integrate the methods of environmental sanitation and the management of community facilities without spread of epidemics. **(K6)**

CO5: Appraise the importance of sustainable development while planning a project or executing an activity. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

AIR POLLUTION:

Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

Learning Outcomes: At the end of this unit, students should be able to

- Understand control mechanism of air pollutants. (L2)
- Design noise reduction techniques. (L6)

UNIT – II (9 Hrs)

INDUSTRIAL WASTE WATER MANAGEMENT:

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of treatment process of industrial effluents. (L2)
- Design treatment plants. (L6)

UNIT – III (9 Hrs)

SOLID WASTE MANAGEMENT: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

HAZARDOUS WASTE: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Learning Outcomes: At the end of this unit, students should be able to

- Categorize of solid waste and separation and procession solid waste. (L4)
- Estimate Hazardous wastes. (L5)
- Develop execute solid waste and hazardous waste management. (L6)

UNIT – IV (9 Hrs)

ENVIRONMENTAL SANITATION: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of hygienic environment. (L2)
- Choose appropriate rural sanitation methods to keep surrounding clean. (L5)

UNIT – V (9 Hrs)

SUSTAINABLE DEVELOPMENT: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability-sustainable
development.

Learning Outcomes: At the end of this unit, students should be able to

- Express sustainable development strategies. (L6)

TEXTBOOKS:

1. "Environmental Engineering", Peavy, H. S., Rowe, D.R, Tchobanoglous, Mc-Graw Hill International Editions, New York 1985.
2. "Environmental Science and Engineering", J. G. Henry and G. W. Heinke, Pearson Education.

REFERENCE BOOKS:

1. "Waste water treatment- concepts and design approach", G. L. Karia and R.A. Christian, Prentice Hall of India
2. "Air pollution", M. N. Rao and H. V. N. Rao, Tata Mc.Graw Hill Company.
3. "Weiner and Robin Matthews Environmental Engineering", Ruth F., Elesevier, 4th Edition, 2003.
4. "Air Pollution and Control", K. V. S. G. Murali Krishna, Kousal & Co. Publications, New Delhi.

Course Code	SMART GRID		L	T	P	C
21A020503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Impart knowledge on relevance smart grids technologies, its potential challenges and applications to the real world.
- Provide deeper insight on the customer's needs and consumption pattern for better load management and forecasting.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operational and functional aspects of smart grid, architecture and technical challenges. **(K2)**

CO2: Analyze the communication signals from various measuring units and sub-networks for monitoring secured operation adhering relevant standards. **(K4)**

CO3: Assess the various energy options and apply them for the sustainability of Smart grid. **(K2)**

CO4: Develop strategies for demand side management using various communication protocols. **(K3)**

CO5: Understand the challenges and relevant standards in interoperability and cyber security of Smart grid. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to Smart Grid: Introduction to smart grid as per National Institute Standards and Technology (NIST), smart grid architecture, functions of smart grid components, smart grid initiatives in India, technology drivers and challenges. Overview of the technologies required for smart grid and architecture of smart substation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concept of smart grid Technology. (L2)
- Explain Smart grid functions. (L3)
- Understand Smart grid architecture. (L2)

<u>UNIT – II</u> (9 Hrs)

Smart Grid Measurement Technology: Introduction, standards for information exchange, monitoring, smart meters, and measurement technologies, WAMS, PMUs, GIS and google mapping tools and multi-agent systems technology.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the measurement technologies. (L2)
- Explain the google mapping tools. (L3)
- Compare WAMS and PMU. (L3)

<u>UNIT – III</u> (9 Hrs)

Sustainable Energy Options for the Smart Grid: Renewable Energy Resources, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, Storage Technologies.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of Renewable energy source. (L3)
- Understand basic concept of Electric Vehicles. (L2)

<u>UNIT – IV</u> (9 Hrs)

Demand Side Management and Communication Technology: Introduction, Demand Side Management objectives and its classification. Communication technologies: IEEE 802X series. Layouts of Sub-networks: LAN, WAN, NAN, HAN and FAN and its comparison.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic concepts of management objectives. (L3)
- Compares the WAN, LAN, NAN, HAN. (L3)

<u>UNIT – V</u> (9 Hrs)

Interoperability, Standards and Cyber Security : Introduction, State-of-the-Art-Interoperability, Benefits and Challenges of Interoperability, Model for Interoperability in the Smart Grid Environment, Smart Grid Network Interoperability, Interoperability and Control of the Power Grid, Standards, Approach to Smart Grid Interoperability Standards, Smart Grid Cyber Security, Cyber Security State of the Art, Cyber Security Risks, cyber security concerns associated with Advanced Metering Infrastructure, Mitigation approach to cyber security risks.

Learning Outcomes: After successful completion of this unit, the students will be able to

- Understand basic Benefits and Challenges of Interoperability. (L2)
- Analyze Smart Grid Network Interoperability. (L4)

<u>TEXTBOOKS:</u>

1. "Smart Grid: Fundamentals of design and analysis", James Momoh, John Wiley & sons Inc, IEEE press, 2012

2. "Smart Grid: Technology and Applications", Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons Inc., 2012.

REFERENCE BOOKS:

1. "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Fereidoon P. Shoshonis, Academic Press, 2012
2. "The smart grid: Enabling energy efficiency and demand response", Clark Grellings, Fairmont Press Inc, 2009.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/107/108107113/
2. https://smartgrid.ieee.org/resources/webinars

<table>
<tr><td>Course Code</td><td rowspan="2">ENERGY STORAGE SYSTEMS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A020504</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="3">VI</td></tr>
</table>

COURSE OBJECTIVES:
- Understand the need for energy storage
- Understand about the fundamentals of ESS
- Know about types, features and benefits of ESS
- Know about various management and control including market potential of ESS
- Study about various applications of ESS

COURSE OUTCOMES:
After completion of the course, the student will be able to

CO1: To get exposed to latest technology of ESS. **(K3)**

CO2: Understand the principle, features, and benefits of ESS. **(K2)**

CO3: Understand the marketing and management strategies of ESS in working environment. **(K2)**

CO4: Distinguish wide variety of applications of EES for practical applications. **(K2)**

CO5: Know about latest technology applications of Battery SCADA, which is going to be vital in future applications, trend in new and renewable energy source. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Fundamentals of ESS: Definitions, Characteristics of ESS, Electricity, and roles of ESSs, Emerging needs in ESS, Classification of ESSs, Roles of Electrical storage technologies.

Learning Outcomes: At the end of the unit, students should be able to
- To know about the fundamentals of ESS. (L4)
- To know about emerging needs and roles of ESS. (L4)
- To know about various classifications of ESS. (L4)
- To understand about roles of energy storage technologies. (L2)

UNIT – II (9 Hrs)

Types and Features of ESS Technologies: Mechanical storage systems, Electromechanical

storage systems, Chemical energy storage, Electrical storage systems, Thermal storage systems, standards for EES, Comparison of ESS technology storage systems, Power and discharge duration, Energy and power density, Storage operating cost, Power quality, Reactive power capability.

Learning Outcomes: At the end of the unit, students should be able to

- To understand about various types of ESS technologies. (L2)
- To understand about standards for ESS. (L2)
- To learn about power and discharge duration of ESS. (L2)
- To know about preliminaries of ESS operating cost. (L4)
- To understand about power quality issues and reactive power capability of ESS. (L2)

UNIT – III (9 Hrs)

Storage Benefits: Definitions, Applications, specifications, benefits, Electric energy time shift, Electric supply capacity, reserve capacity, voltage support, Electric service power quality and reliability, Incidental benefits, energy losses, access charges, Risk, dynamic operating benefits, p.f. correction, reduced air emissions, flexibility, energy benefits.

Learning Outcomes: At the end of the unit, students should be able to

- To know various storage benefits. (L4)
- To distinguish between application specific benefits and identical benefits. (L2)
- To understand about electric service power quality and reliability issues. (L2)
- To learn about energy benefits from storage systems. (L3)

UNIT – IV (9 Hrs)

EES Market and Management: Utility and Consumer use, Measurement and Control hierarchy, Internal configurations, External connections, Battery SCADA, Market potential, estimation, role of aggregators, Maximum market potential estimates, Demand change management, Time-of-use energy cost management, storage modularity.

Learning Outcomes: At the end of the unit, students should be able to

- To understand about management of ESS technologies. (L2)
- To distinguish between internal and external configuration of ESS. (L2)
- To know about battery SCADA system and storage modularity. (L4)
- To distinguish between demand change and time-of-use energy cost management. (L2)

UNIT – V (9 Hrs)

Applications of EES: Power Vs Energy, Capacity Vs energy applications, specific power and discharge durations, Electric supply applications, ancillary service applications, End user/utility customer applications, Distributed energy storage applications, Locational, Non-locational and incidental applications.

Learning Outcomes: At the end of the unit, students should be able to

- To know about various ESS. (L4)
- To distinguish between power, capacity, energy applications of ESS. (L2)
- To distinguish between electric supply and ancillary applications. (L2)
- To understand about the importance of distributed energy storage applications. (L2)

TEXTBOOKS:

1. "Energy Storage Benefits and Market Analysis", James M. Eyer, Joseph J. Iannucci and Garth P. Corey, Sandia National Laboratories, 2004
2. "The Electrical Energy Storage", IEC Market Strategy Board, White paper.

REFERENCE BOOKS:

1. "Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide", Jim Eyer, Garth Corey, Sandia National Laboratories", Feb 2010.

Course Code	AUTOMATION IN INDUSTRIES		L	T	P	C
21A030503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need of automation
- Classify various types of automated transmission lines and components of automation.
- List and understand various material handling systems.
- Design various types of automated assembly systems
- Explain various automatic inspection systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand principles and basic elements of automation. **(K2)**
CO2: Understand the Detroit automation and automated flow lines. **(K2)**
CO3: Learn the material handling technology and assembly systems. **(K1)**
CO4: Learn the control systems technology and its process in automation. **(K1)**
CO5: Understand the inspection, testing and PLC's in automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	3	1	2	1	-	-	-	-	-
CO2	3	-	-	-	2	2	1	-	2	-	-	-	-	-
CO3	3	-	-	-	1	1	1	-	1	-	-	-	-	-
CO4	2	2	3	-	3	2	2	-	2	-	-	-	-	-
CO5	2	-	-	-	2	1	2	-	1	-	-	-	-	-

UNIT – I (9 Hrs)

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break- Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in process.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the principles of production, investment, cost concepts in automation. (L2)

UNIT – II (10 Hrs)

Detroit-Type Automation: Automated Flow lines, Methods of Work-part Transport, Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations.

Analysis of Automated Flow Lines: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the types of automation method concepts and machining operations. (L2)

UNIT – III (11 Hrs)

Material handling and Identification Technologies: The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc.

Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multistation Assembly Machines, Analysis of a Single Station Assembly Machine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Apply the techniques of material handling and automated assembly systems. (L4)

UNIT – IV (7 Hrs)

Control Technologies in Automation: Industrial Control Systems, Process Industries Verses Discrete- Manufacturing Industries, Continuous Verses Discrete Control, Computer Process Control and its Forms. Computer Based Industrial Control: Introduction & Automatic Process Control, Building Blocks of Automation System: LAN, Analog & Digital I/O Modules, SCADA System & RTU.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the industrial control technologies in automation. (L2)

UNIT – V (8 Hrs)

Automated Inspection and Testing: Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods.

Programmable Logic Controllers (PLCs): Introduction, Micro PLC, Programming a PLC, Logic Functions, Input & Output Modules, PLC Processors, PLC Instructions, Documenting a PLC System, Timer & Counter Instructions, Typical PLC Programming Exercises for Industrial Applications.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain the inspection, testing methods and PLC's methods in automation. (L2)

TEXTBOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing", M. P. Grover, Pearson Education.

REFERENCE BOOKS:

1. "Computer Based Industrial Control", Krishna Kant, EEE-PHI
2. "Principles and Applications of PLC", Webb John, Mcmillan 1992
3. "An Introduction to Automated Process Planning Systems", Tiess Chiu Chang & Richard A. Wysk
4. "Anatomy of Automation", Amber G.H & P.S. Amber, Prentice Hall.

Course Code	RAPID PROTOTYPING		L	T	P	C
21A030504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- The fundamental Theory behind RP process.
- Study the Process parameters of different machine.
- Study different types of Rapid tooling.
- Based on the industrial standards, learn how Prepare manufacturing DATA.
- The basics concept of different software used in RP system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Theory behind RP process. **(K2)**
CO2: Learn the Process parameters of different machine. **(K3)**
CO3: Learn different types of Rapid tooling. **(K3)**
CO4: Understand the industrial standards; learn how to prepare manufacturing Data. **(K2)**
CO5: Understand basics concept of different software used in RP system. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	2	3	1	2	-	-	1	-	-	-	-
CO2	2	2	-	3	2	2	2	-	-	1	-	-	-	-
CO3	3	2	-	3	2	1	3	-	-	1	-	-	-	-
CO4	1	2	-	3	3	1	3	-	-	1	-	-	-	-
CO5	1	2	-	3	3	1	3	-	-	1	-	-	-	-

UNIT – I (9 Hrs)

Introduction & History of Rapid Prototyping, Fundamentals of Rapid Prototyping, Advantages and Disadvantages of Rapid Prototyping, Applications of Rapid Prototyping, Classification of RP, Rapid prototyping process chain, Fundamental Automated processes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know about the importance of rapid prototyping. (L1)
- Understand the concept of Stereo lithography. (L2)

UNIT – II (9 Hrs)

Stereo lithography (SLA) system & principle, Process parameter, process details of SLA, Data preparation, data files of SLA, Machine details & Application of SLA.

Selective Laser Sintering (SLS)- Introduction, SLS Machine Type – Details, SLS principle of operation, Process parameters of SLS, Data preparation for SLS.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about the selective laser sintering process. (L4)
- Explain about the concept of fused deposition modelling and solid ground curing. (L2)

<u>UNIT – III</u> (7 Hrs)

Fused Deposition Modeling (FDM) – Introduction, FDM Principles, Process Parameters, Path generation & Application of FDM, Solid Ground curing (SGC) - Principle of operation, SGC machine details & application. Laminate Object Manufacturing (LOM) - Principle of operation, LOM materials, LOM Process details & Application.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Demonstrate about laminated object manufacturing process. (L2)
- Know about different 3D modelling printing techniques. (L1)

<u>UNIT – IV</u> (10 Hrs)

Rapid tooling -Indirect rapid tooling, Silicon Rubber tooling, Aluminium filling epoxy tooling, Spray metal tooling, Direct rapid tooling, Quick cast process, copper Polyamide, DMILS – explanation, Prometals, sand casting tooling, Soft tooling & hard tooling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of rapid tolling. (L2)

<u>UNIT – V</u> (10 Hrs)

Rapid Manufacturing – Introduction, Factors influencing accuracy, Data preparation errors, Part building errors, Errors in finishing, Influence of build orientation.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand different file format software's of 3D modelling techniques. (L2)

<u>TEXTBOOKS</u>:

1. "Stereo lithography and other RP & M Technologies", Paul F. Jacobs, SME, NY 1996.
2. "Rapid Manufacturing", Flham D. T & Dinjoy S.S, Verlog London 2001.
3. "Rapid automated", Lament wood, Indus press New York.

<u>REFERENCE BOOKS:</u>

1. "Wohler's Report 2000", Terry Wohlers, Wohler's Association, 2000.
2. "Rapid prototyping materials", Gurumurthi, IISc Bangalore

Course Code	JAVA PROGRAMMING		L	T	P	C
21A050503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Focus on object oriented concepts and java program structure and its installation.
- Comprehension of java programming constructs, control structures in Java.
- Implementing Object oriented constructs such as various class hierarchies, interfaces and exception handling.
- Understanding of Thread concepts and I/O in Java.
- Being able to build dynamic user interfaces using applets and Event handling in java.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use of objects to program. **(K3)**
CO2: Create programs by using Java basic Constructs. **(K3)**
CO3: Implement OOPs concepts. **(K3)**
CO4: Develop JAVA applets applications. **(K4)**
CO5: Apply multi-threaded concepts in programming. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	-	-	2	2	3	2	-	3	2
CO2	3	2	3	2	3	-	-	2	2	3	-	-	3	2
CO3	3	2	2	1	3	-	-	2	2	3	-	1	1	2
CO4	3	2	2	2	3	-	-	2	2	3	1	-	1	2
CO5	3	2	2	2	3	-	-	2	2	3	1	1	1	2

UNIT – I (8 Hrs)

Introduction to OOP: Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6

Learning Outcomes: At the end of this unit, students should be able to

- Understand the syntax, semantics and features of Java Programming Language. (L1)
- Compare Object Oriented and Procedural Languages. (L4)

UNIT – II (9 Hrs)

Programming Constructs: Variables, Primitive Data types, Identifiers- Naming Coventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control- Branching, Conditional, loops. Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments.

Learning Outcomes: At the end of this unit, students should be able to

- Developing simple programs with java constructs. (L5)
- Learning about various Keywords in Java and their uses. (L1)

<u>UNIT – III</u> (9 Hrs)

Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class. Interfaces, Packages and Enumeration: Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages, using Packages, Access protection, java.lang package. Exceptions & Assertions – Introduction, Exception handling techniques- try catch, throw, throws, finally block, user defined exception.

Learning Outcomes: At the end of this unit, students should be able to

- Implement types of Inheritance and developing new classes based on existing classes. (L4)
- Distinguish between system packages and user defined packages. (L4)
- Demonstrate features of interfaces to implement multiple inheritances. (L3)
- Applying Exception in Programs where necessary. (L4)

<u>UNIT – IV</u> (6 Hrs)

Multi Threading: java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading-Synchronization, suspending and Resuming threads, Communication between Threads Input / Output: reading and writing data, java.io package

Learning Outcomes: At the end of this unit, students should be able to

- Understand concurrency, parallelism and multithreading. (L2)
- Create multitasking applications. (L5)

<u>UNIT – V</u> (9 Hrs)

Applets– Applet class, Applet structure, An Example Applet Program, Applet : Life Cycle, paint(), update() and repaint() Event Handling -Introduction, Event Delegation Model, java.awt. event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the GUI programming. (L2)
- Perform event Handling in java GUI Programs. (L5)

<u>TEXTBOOKS:</u>

1. "The Complete Reference Java", Herbert Schildt, TMH, 8th Edition
2. "Programming in JAVA", Sachin Malhotra, Saurabh choudhary, Oxford.
3. "JAVA for Beginners", Joyce Farrell, Ankit R. Bhavsar, Cengage Learning, 4th Edition.

4. "Object oriented programming with JAVA, Essentials and Applications", Raj Kumar Bhuyya, Selvi, Chu TMH.
5. "Introduction to Java Programming", Y Daniel Liang, Pearson, 7th Edition.

REFERENCE BOOKS:

1. "JAVA Programming", K. Rajkumar. Pearson.
2. "Core JAVA, Black Book", Nageswara Rao, Wiley, Dream Tech
3. "Core JAVA for Beginners", Rashmi Kanta Das, Vikas.
4. "Object Oriented Programming through JAVA", P Radha Krishna, University Press.

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/java/
2. https://www.javatpoint.com/java-tutorial

Course Code	BASICS OF DATABASE MANAGEMENT SYSTEMS		L	T	P	C
21A050504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Provides students with theoretical knowledge and practical skills in the use of databases.
- Database management systems in information technology applications.
- The logical design, physical design and implementation of relational databases are covered.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Define a Database Management System. **(K2)**
CO2: Compare the advantages and disadvantages of the different models. **(K4)**
CO3: Design Database using E-R Diagram (SQL). **(K4)**
CO4: Analyze the rules guiding transaction ACID properties. **(K4)**
CO5: Analyze file organization while storing and retrieving the data base **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	-	2	1	1	2	3	2
CO2	3	2	1	2	1	1	-	-	2	-	1	2	3	2
CO3	3	3	2	2	1	-	-	-	2	-	2	2	1	2
CO4	3	3	2	2	1	-	-	-	2	-	2	2	1	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	1	2

UNIT – I (10 Hrs)

INTRODUCTION: Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Data base systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between Database and File System. (L4)
- Categorize different kinds of data models. (L4)
- Define functional components of DBMS. (L2)

UNIT – II (8 Hrs)

RELATIONAL MODEL: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance **BASIC SQL:** Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).

Learning Outcomes: At the end of this unit, students should be able to

- Outline the elements of the relational model such as domain, attribute, tuple, relation and entity. (L2)
- Distinguish between various kinds of constraints like domain, key and integrity. (L4)
- Define relational schema Develop queries using Relational Algebra and SQL. (L2)
- Perform DML operations on databases. (L4)

UNIT – III (8 Hrs)

ENTITY RELATION MODEL: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. **SQL:** Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations.

Learning Outcomes: At the end of this unit, students should be able to

- Develop E-R model for the given problem. (L4)
- Derive tables from E-R diagrams. (L4)

UNIT – IV (8 Hrs)

TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods: lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes, Database Recovery management : Transaction recovery. SQL constructs that grant access or revoke access from user or user groups. Basic PL/SQL procedures, functions and triggers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various properties of transaction. (L1)
- Design atomic transactions for an application. (L4)
- Gain the knowledge about log mechanism and check pointing techniques for system recovery. (L2)
- Create PLSQL programs and triggers for different database conditions. (L5)

UNIT – V (9 Hrs)

STORAGE AND INDEXING: Database file organization, file organization on disk, heap files and sorted files, hashing, single and multi-level indexes, dynamic multilevel indexing using B-Tree and B+ tree, index on multiple keys.

Learning Outcomes: At the end of this unit, students should be able to

- Understand file organization (L2)
- Compare various indexing techniques (L4)

TEXTBOOKS:

1. "Database Management Systems", Raghuram Krishnan, Johannes Gehrke, TMH, 3rd Edition
2. "Database Management System", Ramez Elmasri, Shamkant B. Navathe, PEA, 6th Edition
3. "Database Principles Fundamentals of Design Implementation and Management", Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

REFERENCE BOOKS:

1. "Database System Concepts", Silberschatz, Korth, TMH, 5th Edition
2. "Introduction to Database Systems", C J Date, PEA, 8th Edition

WEBLINKS

1. https://www.javatpoint.com/dbms-tutorial
2. https://www.geeksforgeeks.org/dbms/

OPEN ELECTIVE – III

Course Code	DISASTER MANAGEMENT AND MITIGATION		L	T	P	C
21A010503			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To obtain the basic knowledge of Environmental Hazards and disasters.
- To understand the basics of Endogenous and Exogenous hazards and gives a suitable picture on the different types of hazard and disaster mitigation methods.
- To understand the key concepts of disaster management related to development and the relationship of different disaster management activities.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze and evaluate the environmental, social, cultural, economic, legal and organizational Aspects influencing vulnerabilities and capacities to face disasters and to know about different types of environmental hazards. **(K4)**

CO2: Compute knowledge on different types of natural and man- made disasters. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery). **(K3)**

CO3: Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ. **(K3)**

CO4: Identify endogenous and exogenous hazards their harmful effects to the environment, Case studies of India. **(K1)**

CO5: Identify the regulatory controls used in hazard management. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO2	3	3	3	3	-	-	2	1	-	-	2	-	2	-
CO3	3	3	3	3	-	-	2	2	-	-	2	-	2	-
CO4	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO5	3	3	2	3	-	-	2	1	-	-	2	-	3	-

UNIT – I (8 Hrs)

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Learning Outcomes: At the end of this unit, students should be able to

- Debate on the Knowledge of the disaster phenomenon, its different contextual aspects, impacts and public health consequences. (L5)

- Express about the natural hazards and its management. (L6)

UNIT – II (10 Hrs)

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

Learning Outcomes: At the end of this unit, students should be able to

- Explain the Capacity to manage the Public Health aspects of the disasters. (L4)
- Distinguish the different types of environmental hazards & disasters. (L5)

UNIT – III (9 Hrs)

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the regulations of building codes and land use planning related to risk and vulnerability. (L4)
- Justify the financial management of disaster and related losses. (L6)

UNIT – IV (9 Hrs)

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Mitigation and control measures of exogenous hazards. (L2)
- Analyze, and communicate information on risks, relief needs and order to formulate strategies for mitigation. (L4)

UNIT – V (9 Hrs)

Soil Erosion: - Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion. Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation. Biological hazards/ disasters:- Population

Explosion.

Learning Outcomes: At the end of this unit, students should be able to

- Relate their interconnections, particularly in the field of the Public Health aspects of the disasters. (L3)
- Understand different approaches to prevent disasters. (L2)

TEXTBOOKS:

1. "Disaster Management", Rajib Shah, Universities Press, India, 2003
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Disaster Mitigation: Experiences and Reflections", Pardeep Sahni
4. "Natural Hazards & Disasters", Donald Hyndman & David Hyndman, Cengage Learning.

REFERENCE BOOKS:

1. "The Environment as Hazards", Kates, B.I & White, G.F, Oxford Publishers, New York, 1978
2. "Disaster Management", R.B. Singh (Ed), Rawat Publication, New Delhi, 2000
3. "Disaster Management", H.K. Gupta (Ed), Universities Press, India, 2003
4. "Space Technology for Disaster Mitigation in India (INCED)", R.B. Singh, University of Tokyo, 1994.

ONLINE LEARNING RESOURCES:

1. http://ndma.gov.in
2. http://www.ndrf.gov.in

Course Code	RENEWABLE ENERGY SYSTEMS		L	T	P	C
21A020505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand various alternate sources of energy for different suitable application requirements. **(K2)**
CO2: Understand the concepts of solar energy generation strategies and wind energy system. **(K2)**
CO3: Analyze Solar and Wind energy systems. **(K4)**
CO4: Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass, and fuel cells. **(K2)**
CO5: Understand the fundamentals of Solar and Wind energy systems. **(K2)**

CO-POMAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

Learning Outcomes: At the end of the unit, students should be able to

- Understanding renewable and nonrenewable energy resources. (L2)
- Understand the various forms of conventional energy resources. (L2)
- Understanding of Solar power properties. (L2)

UNIT – II (8 Hrs)

PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film

PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the PV cells and modules. (L2)
- Disseminate information on PV. (L3)

<u>UNIT – III</u> (10 Hrs)

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

Learning Outcomes: At the end of the unit, students should be able to

- Understanding of wind energy production. (L2)
- Outline division aspects and utilization of renewable energy sources for both domestics and industrial application. (L3)
- Understand the need of Wind Energy and the various components used in energy generation and know the classification. (L2)

<u>UNIT – IV</u> (8 Hrs)

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Learning Outcomes: At the end of the unit, students should be able to

- Identify the Resources of geothermal energy.(L2)

<u>UNIT – V</u> (10 Hrs)

Miscellaneous Energy Technologies: Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the concept of Biomass energy resources and their classification. (L2)
- Analyze the performance of Ocean Energy. (L4)

<u>TEXTBOOKS:</u>

1. “Renewable Energy Power for a Sustainable Future”, Stephen Peake, Oxford International

Edition, 2018.
2. "Non-Conventional Energy Sources", G. D. Rai, Khanna Publishers, 4th Edition, 2000.

REFERENCE BOOKS:

1. "Solar Energy", S. P. Sukhatme, Tata Mc Graw Hill Education Pvt. Ltd, 3rd Edition, 2008.
2. "Non-Conventional Energy Resources", B H Khan, Tata Mc Graw Hill Education Pvt Ltd, 2nd Edition, 2011.
3. "Non-Conventional Energy Resources", S. Hasan Saeed and D. K. Sharma, S. K. Kataria & Sons, 3rd Edition, 2012
4. "Renewable Energy Resource: Basic Principles and Applications", G. N. Tiwari and M. K. Ghosal, Narosa Publishing House, 2004

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

Course Code	CONCEPTS OF ELECTRICAL DRIVES AND APPLICATIONS		L	T	P	C
21A020506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the choice of the electric drive system based on their applications. **(K2)**

CO2: Explain the operation of single and multi-quadrant electric drive. **(K3)**

CO3: Analyze single phase and 3-phase rectifiers fed DC motors and chopper fed DC motors. **(K4)**

CO4: Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors with closed loop, and open loop operations. **(K3)**

CO5: Explain the speed control methods for AC-AC & DC-AC converters fed to Synchronous motors with closed loop, and open loop operations. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Converter Fed DC Motors: Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase semi and fully controlled converters connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basic electrical drive elements and its function. (L2)
- Analyze the single-phase dc drives and its speed-torque characteristics. (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – II (9 Hrs)

Four Quadrant Operation of DC Drives: Introduction to Four Quadrant Operation – Motoring

Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only).

Learning Outcomes: At the end of the unit, students should be able to

- Understand the four-quadrant operation of the dc drives. (L2)
- Analyze the various motoring and braking operations of the dc motors. (L4)
- Understand the closed loop operation of the dc drives. (L2)

UNIT – III (9 Hrs)

Chopper fed DC Motors: Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics– Problems on Chopper Fed D.C Motors.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the basics concepts of choppers and its operation. (L2)
- Analyze the classification of various choppers feeding the dc drives. (L4)

UNIT – IV (9 Hrs)

Control of Induction Motor: Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers–Waveforms – Speed Torque Characteristics - Stator Frequency Control and characteristics. Voltage Source and Current Source Inverter – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Static Rotor Resistance Control

Learning Outcomes: At the end of the unit, students should be able to

- Understand the various speed control methods of induction motor used in drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods to induction motor on rotor side. (L3)

UNIT – V (9 Hrs)

Control of Synchronous Motors: Separate Control & Self Control of Synchronous Motors – Operation of Self-Controlled Synchronous Motors by VSI and CSI. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque Characteristics – Applications – Advantages.

Learning Outcomes: At the end of the unit, students should be able to

- Understand the self and separate control methods of synchronous motor drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods of synchronous motors. (L4)

TEXTBOOKS:

1. "Power semiconductor-controlled drives", G K Dubey, Prentice Hall, 1995.

2. "Modern Power Electronics and AC Drives", B. K. Bose, PHI, 2002.

REFERENCE BOOKS:

1. "Power Electronics", MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. "Power Electronic Circuits, Devices and applications", M. H. Rashid, PHI, 2005.
3. "Electric drives Concepts and Applications", Vedam Subramanyam, Tata McGraw Hill Publications, 2nd Edition, 2011.

Course Code	OPTIMIZATION TECHNIQUES		L	T	P	C
21A030505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the basic fundamentals of optimization methods that can be used during a design process.
- To expose the students to different modern optimization techniques.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand basic theoretical principles of optimization models and its solution. **(K2)**
CO2: Formulate the given practical problem and solving by graphical /simplex method. **(K3)**
CO3: Analyse the cost for transportation and assigning the jobs to machines. **(K3)**
CO4: Analyse the cost and duration of the project, also preparation of job scheduling. **(K3)**
CO5: Use latest methods for optimization. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	1	2	2	1	-	-
CO2	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO3	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO4	3	3	3	3	-	2	-	1	1	-	2	1	-	-
CO5	3	3	3	3	2	2	-	-	2	-	2	1	-	-

UNIT – I (10 Hrs)

Introduction to Optimization: Classification of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems.

Classical Optimization Techniques: Single variable optimization, Multi-variable: Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions

Learning Outcomes: At the end of this unit, students should be able to

- Explain how to formulate statement of optimization problem with or without constraints. (L3)
- Explain about classification of single and multivariable optimization problems. (L3)
- Know about necessary and sufficient conditions in defining the optimization problems. (L1)
- Understand how to formulate Kuhn-Tucker conditions and to solve numerical problems. (L3)

UNIT – II (8 Hrs)

Linear Programming: Statement of an LP problem, Graphical Solution of an LP problem, Simplex method, Two phase method, Dual simplex method.

Learning Outcomes: At the end of this unit, students should be able to

- Formulation of problem as LPP. (L4)
- Solve numerical problems with graphical method, Simplex method, two phase method and dual simplex method. (L4)

UNIT – III (9 Hrs)

Transportation Problems: Introduction, Optimal Solution for BFS, Unbalanced Transportation Problem, Transshipment, Assignment Problems, Hungarian Method.

Learning Outcomes**:** At the end of this unit, students should be able to

- Model linear programming problems like the transportation. (L6)
- Solve the problems of transportation from origins to destinations with minimum time and cost. (L3)
- Solve assignment problems. (L4)

UNIT – IV (10 Hrs)

Project Management: Introduction, Critical Path Method, Critical Path Determination, Optimal Scheduling by CPM, Project Evaluation and Review Technique.

Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

Learning Outcomes: At the end of this unit, students should be able to

- Represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project. (L4)
- Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability. (L4)
- Solve problems of production scheduling. (L3)

UNIT – V (8 Hrs)

Modern Methods of Optimization: An overview of evolutionary algorithms, Genetic algorithms, simulated annealing, fuzzy optimization, neural-network based methods, Particle swarm optimization.

Learning Outcomes**:** At the end of this unit, students should be able to

- Solve the numerical problems using modern optimization techniques. (L4)

TEXTBOOKS:

1. "Engineering Optimization- Methods and Applications", A. Ravindran, K. M. Ragsdell, G.V. Reklaitis, Wiley India Edition, 2nd Edition.
2. "Operations Research: An Introduction", H.A. Taha, PHI Pvt. Ltd., 6th Edition

REFERENCE BOOKS:

1. "Introduction to Optimum Design", J S Arora, Mc-Graw Hill.
2. "Optimization Methods for Engineering Design", Fox, R. L., Addison Wesley, 2001.
3. "Multi-objective optimization using evolutionary algorithms", K Deb John Wiley Publications.
4. "Operations Research", Dr. J. K. Sharma, Mc Millan.
5. "Engineering Optimization: Theory and Practice", Singiresu S. Rao, John Wiley & Sons

Course Code	GLOBAL WARMING AND CLIMATE CHANGES		L	T	P	C
21A030506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To know the basics, importance of global warming.
- To know the concepts of mitigation measures against global warming
- To know the impacts of climate changes

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know the impact of Ozone layer on green house effect and global warming. **(K1)**
CO2: Understand the structure of atmosphere and effects of inversion on pollution dispersion. **(K2)**
CO3: Know the effect of global warming and climatic changes on environment. **(K1)**
CO4: Understand Global change in temperature and climate and measures to reduce the effect. **(K2)**
CO5: Understand the clean technology, use of renewable energy, mitigation technologies and their practices **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO5	1	2	-	2	-	-	-	-	2	-	-	2	-	-

UNIT – I (7 Hrs)

EARTH'S CLIMATE SYSTEM:

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Green house gases and green house effect, Hydrological cycle and Carbon cycle, Global warming and its impacts

Learning Outcomes: At the end of this unit, students should be able to

- Identity the importance of Ozone and effect of green house gases. (L1)
- Know the effect of global warming. (L1)

UNIT – II (9 Hrs)

ATMOSPHERE & ITS COMPONENTS: Atmosphere and its layers-Characteristics of Atmosphere - Structure of Atmosphere - Composition of Atmosphere - Atmospheric stability - Temperature profile of the atmosphere - Temperature inversion and effects of inversion on pollution dispersion.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the layers of atmosphere and their characteristics. (L1)

UNIT – III (8 Hrs)

IMPACTS OF CLIMATE CHANGE: Causes of Climate change - Change of Temperature in the environment - Melting of ice and sea level rise - Impacts of Climate Change on various sectors - Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and its effects on various sectors. (L1)

UNIT – IV (10 Hrs)

OBSERVED CHANGES AND ITS CAUSES: Climate change and Carbon credits-Clean Development Mechanism (CDM), CDM in India - Kyoto Protocol - Intergovernmental Panel on Climate Change (IPCC) - Climate Sensitivity - Montreal Protocol - United Nations Framework Convention on Climate Change (UNFCCC) - Global change in temperature and climate and changes within India

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and carbon credits, effect of change in temperature and climate on India. (L1)

UNIT – V (11 Hrs)

CLIMATE CHANGE AND MITIGATION MEASURES: CDM and Carbon Trading - Clean Technology, biodiesel, compost, biodegradable plastics - Renewable energy usage as an alternative - Mitigation Technologies and Practices within India and around the world - Non-renewable energy supply to all sectors - Carbon sequestration - International and regional cooperation for waste disposal biomedical wastes, hazardous wastes, e-wastes, industrial wastes, etc.,

Learning Outcomes: At the end of this unit, students should be able to

- Know about the clean technology, use of renewable energy, mitigation technologies and their practices. (L1)

TEXTBOOKS:

1. “Climate Change – An Indian Perspective”, Dash Sushil Kumar, Cambridge University Press India Private limited 2007.

REFERENCE BOOKS:

1. “Adaptation and mitigation of climate change-Scientific Technical Analysis”, Cambridge University Press, Cambridge, 2006.
2. “Atmospheric Science”, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.

3. “Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Jan C. van Dam, Cambridge university press, 2003.
4. “Global Warming: Understanding the Forecast””, David Archer, Wiley, 2nd Edition, 2011
5. “Global Warming: The Complete Briefing”, John Houghton, Cambridge University Press, 5th Edition, 2015

Course Code	INTRODUCTION TO INTERNET OF THINGS		L	T	P	C
21A050505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications.

COURSE OUTCOMES:

At the end of the unit, students will be able to:

CO1: Analyze various protocols for IoT. **(K4)**
CO2: Design a PoC of an IoT system using Raspberry Pi/Arduino. **(K3)**
CO3: Apply data analytics and use cloud offerings related to IoT. **(K3)**
CO4: Analyze applications of IoT in real time scenario. **(K4)**
CO5: Analyze applications of IoT in real time Applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	-	2	1	1	2	3	-
CO2	3	2	1	2	1	1	-	-	2	-	1	2	3	-
CO3	3	3	2	2	1	-	-	-	2	-	2	2	3	-
CO4	3	3	2	2	1	-	-	-	2	-	2	2	3	-
CO5	3	3	2	2	1	-	-	-	2	-	2	2	3	-

UNIT – I (10 Hrs)

FUNDAMENTALS OF IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain IoT architecture. (L2)
- Interpret the design principles that govern connected devices. (L2)
- Summarize the roles of various organizations for IoT. (L2)
- Interpret the significance of Prototyping. (L2)

UNIT – II (10 Hrs)

IoT PROTOCOLS: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP

versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basics of microcontrollers. (L2)
- Outline the architecture of Arduino. (L2)
- Develop simple applications using Arduino. (L3)
- Outline the architecture of Raspberry Pi. (L2)
- Develop simple applications using Raspberry Pi. (L3)
- Select a platform for a particular embedded computing application. (L3)

UNIT – III (8 Hrs)

DESIGN AND DEVELOPMENT: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

Learning Outcomes: At the end of this unit, students should be able to

- Interpret different protocols and compare them. (L2)
- Select which protocol can be used for a specific application. (L3)
- Utilize the Internet communication protocols for IoT applications. (L3)
- Select IoT APIs for an application. (L3)
- Design and develop a solution for a given application using APIs. (L6)
- Test for errors in the application. (L4)

UNIT – IV (8 Hrs)

DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

Learning Outcomes: At the end of this unit, students should be able to

- Plan the business model. (L6)
- Predict the market value. (L6)
- Build the product. (L6)

UNIT – V (9 Hrs)

CASE STUDIES/INDUSTRIAL APPLICATIONS: Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the manufacturing techniques. (L2)
- Adapt the Ethics of the IoT. (L6)

TEXTBOOKS:

1. "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

REFERENCE BOOKS:

1. "Database System Concepts", Silberschatz, Korth, TMH, 5th Edition
2. "Introduction to Database Systems", C J Date, PEA, 8th Edition
3. "The Database book principles & practice using Oracle/MySql", Narain Gehani, University Press.

ONLINE LEARNING RESOURCES:

1. https://en.wikipedia.org/wiki/Cloud_computing
2. https://www.infoworld.com/article/2683784/what-is-cloud-computing.html

Course Code	WEB TECHNOLOGIES FOR BEGINNERS		L	T	P	C
21A050506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- This course is designed to introduce students with no programming experience to the programming languages
- Techniques associated with the World Wide Web.
- The course will introduce web-based media-rich programming tools for creating interactive web pages.

COURSE OUTCOMES:

After completing the course student will be able to

CO1: Analyze a web page and identify its elements and attributes. **(K4)**
CO2: Create web pages using XHTML and Cascading Styles sheets. **(K5)**
CO3: Build dynamic web pages. **(K5)**
CO4: Build web applications using PHP. **(K5)**
CO5: Programming through PERL and Ruby, client-side scripts using AJAX **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	3	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	3	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	3	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	3	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	3	-

UNIT – I (9 Hrs)

HTML tags, Lists, Tables, Images, forms, Frames. Cascading style sheets. Introduction to Java script. Objects in Java Script. Dynamic HTML with Java Script

Learning Outcomes: At the end of this unit, students should be able to

- Create standard tags of HTML tags and Knowing the features of designing static web pages. (L6)
- List different types of CSS to design webpage attractively. (L1)
- Apply Java script concepts and create dynamic HTML pages. (L4)

UNIT – II (10 Hrs)

Working with XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how XML interacts with different applications. (L1)
- Examine background applications using XSL and XSLT. (L4)

UNIT – III (9 Hrs)

AJAX A New Approach: Introduction to AJAX, Integrating PHP and AJAX. Consuming WEB services in AJAX: (SOAP, WSDL, UDDI)

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of AJAX Architecture. (L2)
- Integrate and test web services. (L5)

UNIT – IV (9 Hrs)

PHP Programming: Introducing PHP: Creating PHP script, Running PHP script. Working with variables and constants: Using variables, Using constants, Data types, Operators. Controlling program flow: Conditional statements, Control statements, Arrays, functions. Working with forms and Database such as my Sql.

Learning Outcomes: At the end of this unit, students should be able to

- Develop PHP Programs using WAMP and XAMPP Server. (L3)
- Create a website with a Database (My SQL) in PHP. (L5)

UNIT – V (8 Hrs)

Introduction to PERL, Perl language elements, Interface with CGI- A form to mail program, Simple page search

Learning Outcomes: At the end of this unit, students should be able to

- Creating simple programs with PERL. (L4)
- Comparing CGI with other server-side technologies. (L5)

TEXTBOOKS:

1. “Programming the World Wide Web”, Robert W Sebesta, Pearson Education, 7th Edition
2. “Web Technologies”, Uttam K Roy, Oxford University Press
3. “The Web Warrior Guide to Web Programming”, Bai, Ekedahl, Farrelll, Gosselin, Zak, Karparhi, Maclntyre, Morrissey, Cengage Learning

REFERENCE BOOKS:

1. “Ruby on Rails Up and Running, Lightning fast Web development”, Bruce Tate, Curt Hibbs, Oreilly Media Inc., 2006

2. “Programming Perl”, Tom Christiansen, Jonathan Orwant, Oreilly Media Inc., 4th Edition, 2012
3. “Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX”, Black book, Dream Tech.
4. “An Introduction to Web Design, Programming”, Paul S Wang, Sanda S Katila, Cengage Learning.

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/html/
2. https://www.w3schools.com/js/
3. https://www.w3schools.com/xml/xml_whatis.asp
4. https://www.w3schools.com/php/

OPEN ELECTIVE – IV

Course Code	COST EFFECTIVE HOUSING TECHNIQUES		L	T	P	C
21A010504			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To train the students to have a comprehensive knowledge of planning, design, evaluation, construction
- To train the students to financing of housing projects
- To Provide Knowledge on cost effective construction materials and methods.
- To teach the principles of sustainable housing policies and programmes.

COURSE OUTCOMES:

At the end of the course, student will be able to

CO1: Understand about planning, design, evaluation, construction and financing of housing projects with cost effective housing techniques. **(K2)**

CO2: Choose the basic housing programmes and services and slum improvement and relocation. **(K3)**

CO3: The student can be in a position to adopt the suitable techniques in construction of low cost constructions. **(K6)**

CO4: Understand about alternate building materials for low cost housing techniques and sanitation services in rural areas. **(K2)**

CO5: The student can be in a position to analyze the suitable techniques in rural and disaster prone areas by using locally available materials. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

INTRODUCTION TO HOUSING: Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the about basics about housing norms. (L4)
- Understand the objectives and strategies of housing policies. (L2)

UNIT – II (9 Hrs)

HOUSING PROGRAMMES: Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate the usage of GIS and MIS in housing projects. (L4)
- Explain about development of plots and gated communities. (L4)

UNIT – III (9 Hrs)

DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY: Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements - Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall - Fly ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

Learning Outcomes: At the end of this unit, students should be able to

- Write about the adoption of Economical Wall System. (L6)
- Write about Adoption of precast R.C. plank and join system for roof/floor in the building. (L6)

UNIT – IV (9 Hrs)

ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING AND INFRASTRUCTURE SERVICES IN RURAL HOUSES: Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Low cost Infrastructure services: Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy. Rural Housing**:** Introduction traditional practice of rural housing continuous - Mud Housing technology-Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs.

Learning Outcomes: At the end of this unit, students should be able to

- Determine about alternate building materials for low cost housing construction. (L3)
- Justify about low cost sanitation from traditional methods. (L6)

UNIT – V (9 Hrs)

HOUSING IN DISASTER PRONE AREAS: Introduction – Earthquake - Damages to houses -

Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirements of structural safety of thin pre-cost roofing units against Earthquake forces -Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about Type of Damages and Railways of non-engineered buildings. (L4)
- Express about Repair and restore action of earthquake Damaged structures and for future constructions. (L6)

TEXTBOOKS:

1. "Hand book of Low Cost Housing", A. K. Lal, New Age International publishers.
2. "Low Cost Housing", G.C. Mathur, IBH Publishers.
3. "Housing in India", Francis Cherunilam and Odeyar D Heggade, Himalaya Publishing House, Bombay, 1997.

REFERENCE BOOKS:

1. "Disaster Management", Rajib Shaw, Universities Press, India.
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Building Materials For Low–Income Houses", International Council For Building Research Studies And Documentation.
4. "Modern Trends In Housing In Developing Countries", A.G. Madhava Rao, D.S. Rama Chandra Murthy & G. Annamalai.
5. "Properties of Concrete"', Neville A.M. Pitman Publishing Limited, London.
6. "Light Weight Concrete", Academic Kiado, Rudhai.G, Publishing home of Hungarian Academy of Sciences, 1963.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/124107001
2. https://nptel.ac.in/courses/105103206
3. https://onlinecourses.nptel.ac.in/noc20_ar14/preview4

Course Code	ENERGY CONSERVATION AND MANAGEMENT		L	T	P	C
21A020507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Familiarize present energy scenario, and energy auditing methods.
- Explain components of electrical systems, lighting systems and improvements in performance. Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
- Train on energy conservation in major utilities.
- Instruct principles of energy management and energy pricing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain Energy Utilization and Energy Auditing Methods. **(K3)**

CO2: Analyse Electrical Systems Performance of Electric Motors and Lighting Systems. **(K4)**

CO3: Examine Energy Conservation Methods in Thermal Systems. **(K3)**

CO4: Estimate Efficiency of Major Utilities Such as Fans, Pumps, Compressed Air Systems, Havoc and D.G. Sets. **(K2)**

CO5: Elaborate Principles of Energy Management, Programs, Energy Demand and Energy Pricing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction: Energy – Power – Past & Present Scenario of World; National Energy Consumption Data – Environmental Aspects Associated with Energy Utilization –Energy Auditing: Need, Types, Methodology And Barriers. Role of Energy Managers, Instruments for energy auditing.

Learning Outcomes: At the end of this unit, students should be able to

- Infer energy consumption patterns and environmental aspects of energy utilization. (L4)
- Outline energy auditing requirements, tools, and methods. (L3)
- Identify the function of energy manager. (L2)

UNIT – II (9 Hrs)

Electrical Systems: Components of EB Billing – HT And LT Supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of Lighting, Efficacy, LED Lighting And Scope Of Economy In Illumination.

Learning Outcomes: At the end of this unit, students should be able to

- Outline components of electricity billing, transmission, and distribution. (L3)
- Analyse performance characteristics of transformers, capacitors, and electric motors. (L4)
- Examine power factor improvements, and electric motor efficiency. (L3)
- Evaluate lighting systems. (L4)

UNIT – III (9 Hrs)

Thermal Systems: Stoichiometry, Boilers, Furnaces, and Thermic Fluid Heaters – Efficiency Computation and Encon Measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, and Insulators & Refractory's.

Learning Outcomes: At the end of this unit, students should be able to

- Determine efficiency of boilers, furnaces, and other thermal systems. (L3)
- Recommend energy conservation measures in thermal systems. (L2)
- Justify steam systems in energy conservation. (L3)

UNIT – IV (9 Hrs)

Energy Conservation in Major Utilities: Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. Sets.

Learning Outcomes: At the end of this unit, students should be able to

- Explain energy conservation measures in major utilities. (L3)
- Apply performance test criteria for fans, pumps, compressors, havoc systems. (L3)
- Assess energy conservation in cooling towers and D.G. sets. (L3)

UNIT – V (9 Hrs)

Energy Management: Principles of Energy Management, Energy demand estimation, Organizing and Managing Energy Management Programs, Energy pricing.

Learning Outcomes: At the end of this unit, students should be able to

- Describe principles of energy management. (L2)
- Assess energy demand and forecast, organize energy management programs. (L3)
- Design elements of energy pricing. (L5)

TEXTBOOKS:

1. "Energy Manager Training Manual", A Website Administered by Bureau of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government of India, 2004, 4 Volumes Available at www.energymanagertraining.com

REFERENCE BOOKS:

1. "Industrial Energy Management and Utilisation", Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988.
2. "Design and Management for Energy Conservation", Callaghn, P.W., Pergamon Press, Oxford, 1981
3. "The Efficient Use of Energy", Dryden. I.G.C., Butter worths, London, 1982
4. "Energy Management", Murphy. W. R. and G. Mc Kay, Butter worths, London 1987

Course Code	BASICS OF POWER ELECTRONICS		L	T	P	C
21A020508			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operation, characteristics, and usage of power semiconductor devices. **(K2)**
CO2: Understand different types of Rectifier circuits with different operating conditions. **(K2)**
CO3: Understand DC-DC converters operation and analysis of their characteristics. **(K2)**
CO4: Understand the construction and operation of voltage source inverters. **(K2)**
CO5: Apply all the above concepts to solve various numerical problem solving. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	1	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-	1	-

UNIT – I (9 Hrs)

Power Switching Devices: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

Learning Outcomes: At the end of this unit, students should be able to

- Know the V-I characteristics of different semi-conductor devices. (L4)
- Importance of drive circuit for MOSFET, IGBT and GTO. (L3)

UNIT – II (9 Hrs)

Rectifiers: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance.

Learning Outcomes: At the end of this unit, students should be able to

- Derivation of expressions of different configurations of rectifiers. (L3)

- Calculate the Average, R.M.S values of Voltages and Currents. (L4)

UNIT – III (8 Hrs)

DC-DC converters: Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of duty cycle. (L2)
- Analysis of waveforms at steady state of power circuit. (L4)
- Derivation of average output voltage of DC-DC converter. (L3)

UNIT – IV (9 Hrs)

Inverter: Single phase Voltage Source inverters– operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters –Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle operationally.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of pulse width modulation. (L2)
- Analysis of waveforms of single phase and three phase bridge inverters. (L4)

UNIT – V (10 Hrs)

AC voltage controllers & Cyclo converters: voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of TRIAC – TRIAC with R and RL loads– RMS load voltage, current and power actor-waveforms. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down Cyclo converters with Resistive load, Principle of operation, Waveforms, output voltage.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of the phase control and integral cycle control. (L2)
- Know the principal operation of voltage and frequency converter. (L4)
- Analysis waveforms of ac voltage converter and Cyclo converter. (L4)

TEXTBOOKS:

1. "Power Electronics: Circuits, Devices and Applications", M. H. Rashid, Prentice Hall of India, 2nd Edition, 1998
2. "Power Electronics", P. S. Bimbhra, Khanna Publishers, 4th Edition, 2010.
3. "Power Electronics", M. D. Singh & K. B. Khanchandani, Tata Mc Graw Hill Publishing Company, 1998.

REFERENCE BOOKS:

1. "Power Electronics", Ned Mohan, Wiley, 2011
2. "Fundamentals of Power Electronics", Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004
3. "Power Electronics", Vedam Subramanyam, New Age International (P) Limited, 1996.
4. "Power Electronics", V. R. Murthy, Oxford University Press, 1st Edition, 2005.
5. "Power Electronics", P. C. Sen, Tata Mc Graw-Hill Education, 1987
6. "Power Electronic Control of Alternating Current Motors", J. M. D. Murphy.

Course Code	BASICS OF AUTOMOTIVE ENGINEERING		L	T	P	C
21A030507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce various components of an automobile and engine sub systems.
- To impart knowledge on various safety systems of an automobile and emission norms.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the various components of an automobile and Working of fuel supply system. **(K2)**
CO2: Know the working of various lubrication and cooling systems. **(K1)**
CO3: Familiarize with the various systems such as ignition system and transmission system. **(K2)**
CO4: Explain the suspension, braking systems of an automobile and their differences. **(K2)**
CO5: Know about the emissions from engine and safety norms for the operation of an automobile. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction: classification of automobiles, Components of four wheeler automobile- chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive

Fuel supply systems: simple fuel supply system in petrol and diesel engines. Working of simple Carburetor, direct fuel injection system in diesel engine.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the parts of automobile engines. (L2)
- Understand the concept of fuel supply systems. (L2)

UNIT – II (7 Hrs)

Lubricating System: Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.

Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the function of Lubricating system. (L3)

UNIT – III (10 Hrs)

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, Electronic ignition system.

Transmission system: Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, Types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

***Learning Outcomes*: At the end of this unit, students should be able to**

- Understand the concept of Ignition system and its types. (L2)
- Understand the concept of Transmission system. (L2)

UNIT – IV (10 Hrs)

Suspension System: Objectives of suspension system, front suspension system rigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

***Learning Outcomes*: At the end of this unit, students should be able to**

- Understand the working of suspension system and its types. (L2)
- Analyze the different types of braking systems. (L3)

UNIT – V (9 Hrs)

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. Engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

***Learning Outcomes*: At the end of this unit, students should be able to**

- Understand emission concept in automobiles engines. (L2)
- Understand the concept of safety system. (L2)

TEXTBOOKS:

1. "Automobile Engineering Vol-1 & vol-2", Kirpal Singh, Standard Publishers Distributors, 11th Edition.
2. "Automotive Mechanics", William H Crouse & Donald LAnglin, Tata Mc Graw Hill Publications, 10th Edition.
3. "Automobile Engineering", Rajput, Laxmi Publications.

REFERENCE BOOKS:

1. "Automobile Engineering", R.B Gupta, Satya Prakashan Publications, 6th Edition.

2. "The Motor vehicle", Newton steeds & Garrett, Society of Automotive Engineers, 13th Edition.
3. "Automotive Engineering", G.B.S. Narang, Khanna Publishers, 5th Edition.
4. "Automotive Mechanics", Joseph Heitner, IPC Transport Press Ltd, 2nd Edition.
5. "The Automobile", Harbans Singh Reyat, S. Chand & company Pvt. Ltd., 6th Edition.

Course Code	BASICS OF TOTAL QUALITY MANAGEMENT		L	T	P	C
21A030508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concept of quality, cost of quality, international quality standards.
- To learn the principles of Total quality management, techniques for problem solving.
- To learn about various tools of quality management used in various industrial applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts of Quality and Quality Control Techniques. **(K2)**
CO2: Understand TQM concepts and History and able to use quality tools for problem solving. **(K2)**
CO3: Use TQM techniques and to formulate quality circles to find solutions with team work. **(K2)**
CO4: Apply various TQM Methods to solve problems in industry. **(K3)**
CO5: Analyze various quality problems and contribute towards continuous improvement in the system. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	2	-	2	2	2	-	2	-	-	-	2	-	-
CO5	1	-	-	-	-	2	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Inspection & Quality Control

Statistical Quality Control (SQC) – Techniques - variables and attributes Control charts : $\overline{X}$ - R Charts, P-Chart, C-Chart. Acceptance Sampling – Single and Double sampling Plan - OC Curves. BIS and ISO Standards – Importance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Control charts: $\overline{X}$ - R Charts, P-Chart, C-Chart, single and double sampling plans and BIS&ISO standards. (L1)

UNIT – II (8 Hrs)

TQM – concepts, History-Quality management philosophies-Juran, Deming, Crosby, Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – internal and external customers - TQM tools & techniques- 7 QC tools- 7 New QC tools.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various quality management philosophies, Evaluation of TQM, TQM tools and technologies. (L1)

<u>UNIT – III</u> (10 Hrs)

Problem solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis, Quality circles – organization – team approach.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse Problem solving process, system failure analysis, fault tree analysis, pedigree analysis and concept Quality circles. (L4)

<u>UNIT – IV</u> (10 Hrs)

Quality Function Development (QFD) – elements of QFD –benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Know the procedure for quality function development, bench marking, taguchi analysis. (L1)

<u>UNIT – V</u> (8 Hrs)

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management, Six sigma approach – application of six sigma approach to various industrial situations.

Learning Outcomes: At the end of this unit, students should be able to

- Know the value improvement, supplier teaming and the concept of business process re-engineering, supply chain management and six sigma. (L1)

<u>TEXTBOOKS:</u>

1. “Total Quality Management”, D.R.Kiran, BS Publications, 2016
2. “Total Quality Management”, Bester field, Pearson.

<u>REFERENCE BOOKS:</u>

1. “Quality management”, Howard Giltow, TMH
2. “Quality management”, Evans.
3. “Quality management”, Bedi
4. “Total Quality Management”, Joseph & Susan Berg

5. “Total Quality Management-Toward the Emerging Paradigm”, Bounds, Yorks, Adams, Ranney, McGraHill, 1994

Course Code	CLOUD COMPUTING – AWS		L	T	P	C
21A050507			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Define cloud services and models
- Demonstrate design the architecture for new cloud application.
- Explain how to re-architect the existing application for the cloud

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the procedure for Cloud deployment. **(K3)**
CO2: Distinguish different cloud service models and deployment models. **(K3)**
CO3: Compare different cloud services. **(K4)**
CO4: Implementation of various services in cloud environment. **(K5)**
CO5: Design applications for an organization which use cloud environment. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	2	1	-	-	1	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-	2	2
CO4	3	-	2	-	-	-	-	-	3	-	-	-	-	2
CO5	3	-	2	-	-	-	-	-	3	-	-	-	-	2

UNIT – I (9 Hrs)

Introduction to Cloud Computing: Introduction to Cloud Computing, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the Cloud characteristics and models. (L2)
- Classify different models, different technologies in cloud. (L2)

UNIT – II (9 Hrs)

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and Management Services, Identity and Access Management Services, Open Source Private Cloud

Software, Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the Services and Platform of cloud. (L2)
- Demonstrate Hadoop Cluster Setup. (L2)

UNIT – III (9 Hrs)

Cloud Application Design: Design Considerations, Reference Architectures, Cloud Application Design Methodologies, Data Storage Approaches, Multimedia Cloud: Introduction, Case Study: Live Video Streaming App, Streaming Protocols, Case Study: Video Transcoding APP.

Learning Outcomes: At the end of this unit, students should be able to

- Design and build cloud applications. (L6)
- Describe the multimedia cloud. (L2)

UNIT – IV (10 Hrs)

Python for Amazon Web Services: Python for Amazon Web Services, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.

Learning Outcomes: At the end of this unit, students should be able to

- Select different cloud services from different vendors. (L2)
- Utilize Python language to access cloud services. (L3)

UNIT – V (8 Hrs)

Case Study: Various Web Applications - Cloud Application Development in Python, Design Approaches, Image Processing APP, Document Storage App, Social Media Analytics App, Cloud Application Benchmarking and Tuning, Cloud Security, Cloud Computing for Education.

Learning Outcomes: At the end of this unit, students should be able to

- Investigate different Cloud applications. (L4)
- Design cloud applications using Python. (L6)

TEXTBOOKS:

1. "Cloud Computing: A Hands-on Approach", Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

REFERENCE BOOKS:

1. "Azure in Action", Chris Hay, Brian Prince, Manning Publications [ISBN: 9781935182481], 2010.
2. "Introducing Windows Azure" Henry Li, Apress, 1st Edition [ISBN: 978-14302-2469- 3], 2009.

Course Code	BASICS OF CRYPTOGRAPHY & NETWORK SECURITY		L	T	P	C
21A050508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand essential building blocks and basic concepts of cyber security
- Explore Web security and Network security
- Explain the measures for securing the networks and cloud
- Understand privacy principles and policies
- Describe the legal issues and ethics in computer security

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection. **(K3)**

CO2: Assess the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure. **(K4)**

CO3: Identify the nature of secure software development and operating systems. **(K3)**

CO4: Demonstrate the role security management in cyber security defense. **(K2)**

CO5: Adapt the legal and social issues at play in developing solutions. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	2
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Vulnerabilities, threats and. Counter measures for computer security. (L2)
- Interpret the design of the malicious code. (L2)

UNIT – II (9 Hrs)

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Root kit.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the attacks on browser, Web and email. (L2)
- Explain the security aspects of Operating Systems. (L3)

UNIT – III (9 Hrs)

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management.

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network security threats and attacks. (L3)
- Design the Counter measures to defend the network security attacks. (L4)
- Analyze the security tools and techniques for Cloud computing. (L4)

UNIT – IV (9 Hrs)

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster

Learning Outcomes: At the end of this unit, students should be able to

- Interpret the need for Privacy and its impacts of Emerging Technologies. (L2)
- Explain how to handle incidents and deal with Disaster. (L2)

UNIT – V (8 Hrs)

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

Learning Outcomes: At the end of this unit, students should be able to

- Adapt legal issues and ethics in computer security. (L4)
- Elaborate on the Emerging topics. (L4)

TEXTBOOKS:

1. "Security in Computing", Charles P. Fleeger, Prentice Hall, 5th Edition, 2010.
2. "Applied Cryptography", Bruce Schneier, John Wiley & Sons, 2nd Edition,1996

REFERENCE BOOKS:

1. "Information Security: The Complete Reference", Mark Rhodes-Ousley, 2nd Edition,
2. "Information Security Management: Concepts and Practice", McGraw-Hill, 2013.
3. "Roadmap to Information Security for IT and Infosec Managers", Michael E. Whitman and Herbert J. Mattord, Boston, MA: Course Technology, 2011

ONLINE LEARNING RESOURCES:

1. https://www.geeksforgeeks.org/cryptography-and-network-security-principles
2. https://onlinecourses.nptel.ac.in/noc22_cs90/preview

HONOURS

Course Code	ADVANCED MOSFET MODELING		L	T	P	C
21A04HN01			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To Derive mathematical models for advanced MOS devices.
- To Provide solution to overcome short channel issues.
- To develop various compact models suitable for industry.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop knowledge on physics involved in modelling of semiconductor devices. **(K3)**
CO2: Develop knowledge on physics involved in MOSFET devices. **(K3)**
CO3: Analyze various MOSFETs to overcome short channel issues. **(K4)**
CO4: Model MOSFEET device for noise effects and process variations. **(K3)**
CO5: Develop various compact MOSFET models suitable for industry. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	1	-	-	-	-	-	-	-	2	-	3
CO2	3	2	-	1	-	-	-	-	-	-	-	2	-	3
CO3	3	2	1	1	1	-	-	-	-	-	-	2	-	3
CO4	3	2	1	1	1	-	-	-	-	-	-	2	-	3
CO5	3	2	1	1	1	-	-	-	-	-	-	2	-	3

UNIT – I (12 Hrs)

BASIC DEVICE PHYSICS: Intrinsic and extrinsic semiconductors, direct and indirect semiconductors- Electrons and holes in silicon energy bands: electron and hole densities in equilibrium- Fermi Dirac statistics, carrier concentration, ionization of impurities. Carrier transport in silicon: drift current, diffusion current. pn junctions built in potential, electric field, current voltage characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Study the characteristics of different semiconductors. (L1)
- Understand the concepts of carrier concentration and transportation in Si. (L2)
- Understand the V-I characteristics of PN junction. (L2)

UNIT – II (12 Hrs)

MOSFET DEVICES: MOS capacitors surface potential- structure characteristics, electrostatic potential and charge distribution- threshold voltage- polysilicon work function- interface states and oxide traps. Long channel MOSFETs: threshold voltage, substrate bias and temperature dependence of threshold voltage, drain current model, subthreshold characteristics, channel mobility, capacitances.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the physics of MOSFETs. (L2)
- Derive the expression for threshold voltage of MOSFET. (L2)
- Explain the current model and subthreshold characteristics of MOSFETs. (L3)

UNIT – III (10 Hrs)

NANO SCALED MOSFETs: Scaling of MOSFETs: Short channel MOSFETs – short channel effects, velocity saturation, channel length modulation, DIBL, GIDL. Variability in MOSFETs. Reliability of MOSFETs high field effects, hot carrier degradation, negative bias temperature instability, MOSFET breakdown, high k dielectrics. Non classical MOSFETs: SOI MOSFETs Current voltage equations, fully depleted SOI MOSFETs, partially depleted SOI MOSFETs, Heterostructure MOSFETs, strained channel MOSFETs, Power MOSFETs, SiC MOSFETs-Silicon Nanowires-Carbon Nanotubes.

Learning Outcomes: At the end of this unit, students should be able to

- Explain various short channel effects of MOSFETs. (L3)
- Understand the effect of temperature and high electric fields on MOSFETs. (L2)
- Compare various non-classical MOSFETs. (L3)

UNIT – IV (8 Hrs)

NOISE MODELING AND PROCESS VARIATION: Noise sources in MOSFET: Flicker noise modeling, Thermal noise modeling- model for accurate distortion analysis- nonlinearities in CMOS devices and modeling- calculation of distortion in analog CMOS circuits. Influence of process variation- modeling of device mismatch for Analog/RF Applications- Benchmark circuits for quality assurance- Automation of the tests.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various noise sources in MOSFETs. (L2)
- Calculate distortion in analog CMOS circuits. (L3)
- Model the effects of process variations in different applications of MOSFETs. (L3)

UNIT – V (8 Hrs)

COMPACT MODELS FOR CIRCUIT SIMULATORS: Introduction to compact models, SPICE Level 1, 2 and 3 MOS models, BSIM model, EKV model, High frequency models-Parameter extraction of MOSFETs.

Learning Outcomes: At the end of this unit, students should be able to

- Explain various models of MOSFETs. (L3)
- Extract parameters of MOSFET device models. (L3)

TEXTBOOKS:

1. "Fundamentals of Modern VLSI Devices", Taur and T. H. Ning, Cambridge University Press, Cambridge, United Kingdom, 1998.
2. "Device Modeling for Analog and RF CMOS Circuit Design", Trond Ytterdal, Yuhua Cheng and Tor A. Fjeldly Wayne Wolf, John Wiley & Sons Ltd,2003.
3. "Solid State Electronic Devices", B. G. Streetman and S. Banarjee, 6th edition‖, Prentice Hall of India Pvt. Ltd, New Delhi, India, 2005.
4. "Semiconductor Devices – Modeling and Technology", N. Das Gupta and A. Das Gupta, Prentice Hall of India Pvt. Ltd, New Delhi, India, 2004.

REFERENCE BOOKS:

1. "Compact MOSFET Models for VLSI Design", A. B. Bhattacharyya, John Wiley & Sons Inc., 2009.
2. "Strained silicon hetero structures: materials and devices", C. K. Maiti, N. B. Chakrabarti, S. K. Ray, The Institution of Electrical Engineers, London, United Kingdom, 2001.
3. "BSIM 4 and MOSFET Modeling for IC simulation", Weidong Liuand Chemming Hu‖, World scientific and Publishing Co. Pvt. Ltd.2011

ONLINE LEARNING RESOURCES:

1. www.fairchildsemi.com/products/discretes/fets/
2. www.mosis.com/pages/Technical/Testdata/submicron-spice-parameters
3. en.wikipedia.org/wiki/Carbon_nanotube
4. www.nxp.com/wcm_documents/models/mos-models/model-9/aacd96_sel
5. web.cs.mun.ca/~paul/transistors/node3.html
6. www.elab.ntua.gr/bemos/index.html

Course Code	VLSI SIGNAL PROCESSING		L	T	P	C
21A04HN02			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To acquire knowledge on signal processing system and various techniques of power reduction.
- To realize various adders and multipliers and optimize their operation by reducing the redundant operations
- To apply the concept of pipelined architecture for various combinational and sequential circuits.
- To design Low Power IIR filters

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the signal processing techniques for power reduction. **(K3)**
CO2: Apply bit level arithmetic structures to design multipliers. **(K3)**
CO3: Realize various adders and optimize their operation by reducing the redundant operations. **(K3)**
CO4: Apply the concept of pipelined architecture for various combinational and sequential circuits. **(K3)**
CO5: Design low power IIR filters. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	3	-	3
CO2	3	2	2	2	1	-	-	-	-	-	-	3	-	3
CO3	3	2	2	2	1	-	-	-	-	-	-	3	-	3
CO4	3	2	2	2	1	-	-	-	-	-	-	3	-	3
CO5	3	3	3	3	3	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

Transformations for retiming. Folding and unfolding DSP programs.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various transformation techniques of DSP. (L2)
- Apply signal processing techniques for power reduction. (L3)

UNIT – II (11 Hrs)

Bit level arithmetic structures- parallel multipliers, interleaved floor plan and bit plan based digital filters. Bit serial multipliers. Bit serial filter design and implementation. Canonic signed digit arithmetic, Distributed arithmetic.

Learning Outcomes: At the end of this unit, students should be able to

- Understand bit level structures. (L2)
- Apply bit level structures to design multipliers. (L3)

- Design various digital filters. (L3)

UNIT – III (10 Hrs)
Redundant arithmetic, redundant number representations, carry free radix 2 addition and subtraction . Hybrid radix 4 addition. Radix 2 hybrid redundant multiplication architectures, data format conversion. Redundant to nonredundant converter. Numerical strength reduction.
Learning Outcomes: At the end of this unit, students should be able to

- Understand various redundant and radix techniques. (L2)
- Apply redundant and radix techniques to realize various adders. (L3)

UNIT – IV (10 Hrs)
Synchronous pipelining and clocking styles, clock skew and clock distribution in bit level pipelined VLSI designs. Wave pipelining, constraint space diagram and degree of wave pipelining. Implementation of wave-pipelined systems. Asynchronous pipelining.
Learning Outcomes: At the end of this unit, students should be able to

- Understand pipelining structures. (L2)
- Apply different pipelining structures to implement digital systems. (L3)
- Implement synchronous and asynchronous pipelined architectures. (L3)

UNIT – V (10 Hrs)
Scaling versus power consumption. Power analysis, power reduction techniques, power estimation techniques. Low power IIR filter design. Low power CMOS lattice IIR filter.
Learning Outcomes: At the end of this unit, students should be able to

- Understand various power reduction techniques. (L2)
- Analyze and estimate the power consumption of digital circuits. (L4)
- Design low power IIR filters. (L5)

TEXTBOOKS:

1. "VLSI Digital Signal Processing systems", K.K. Parhi, John Wiley, 1999.
2. "VLSI and Modern Signal Processing", Kung S. Y, H. J. While House, T. Kailath, 1985, Prentice Hall.

REFERENCE BOOKS:

1. "Design of Analog – Digital VLSI Circuits for Telecommunications and Signal Processing", Jose E. France, Yannis Tsividis, 1994, Prentice Hall.
2. "VLSI Digital Signal Processing", Medisetti V. K, 1995, IEEE Press (NY), USA.

Course Code	CAD FOR VLSI		L	T	P	C
21A04HN03			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand various phases of CAD for digital electronic systems, from digital logic simulation to physical design, including test and verification.
- To Optimize the implemented design for area, time and power by applying suitable constraints.
- To Gain knowledge on methodologies involved in design, verification and implementation of digital designs on reconfigurable hardware platform (FPGA)
- To Acquire knowledge on the methodologies involved in design, verification and implementation of digital designs on MCMs.
- To Develop various algorithms at various levels of physical design.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Establish comprehensive understanding of the various phases of CAD for digital electronic systems, from digital logic simulation to physical design, including test and verification. **(K3)**

CO2: Analyze physical design problems and employ appropriate automation algorithms for partitioning and floor planning. **(K4)**

CO3: Develop the algorithms of placement in physical design process. **(K3)**

CO4: Optimize the implemented design for area, timing and power by applying suitable constraints in routing. **(K4)**

CO5: Analyze the methodologies involved in design verification and implementation of digital designs on MCMs (Multi-Chip Modules). **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	-	-	-	-	-	-	3	-	3
CO2	3	3	2	2	3	-	-	-	-	-	-	3	-	3
CO3	3	3	2	2	3	-	-	-	-	-	-	3	-	3
CO4	3	3	2	2	3	-	-	-	-	-	-	3	-	3
CO5	3	3	2	2	3	-	-	-	-	-	-	3	-	3

UNIT – I (10 Hrs)

VLSI Physical Design Automation VLSI Design Cycle, New Trends in VLSI Design Cycle, Physical Design Cycle, New Trends in Physical Design Cycle, Design Styles, System Packaging Styles.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of physical design and automation VLSI design cycle and its new trends. (L2)

- Establish comprehensive understanding of the various phases of CAD for digital electronic systems, from digital logic simulation to physical design, including test and verification. (L3)

UNIT – II (10 Hrs)

Partitioning, Floor Planning, Pin Assignment and Placement Partitioning – Problem formulation, Classification of Partitioning algorithms, Kernighan-Lin Algorithm, Simulated Annealing.
Floor Planning – Problem formulation, Classification of floor planning algorithms, constraint based floor planning, Rectangular Dualization, Pin Assignment – Problem formulation, Classification of pin assignment algorithms, General and channel Pin assignments.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concepts of floor planning and various partitioning algorithms. (L3)
- Analyze physical design problems and employ appropriate automation algorithms for partitioning and floor planning (L4)

UNIT – III (10 Hrs)

Placement – Problem formulation, Classification of placement algorithms, Partitioning based placement algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concepts of placement and partitioning based placement algorithms. (L3)

UNIT – IV (10 Hrs)

Global Routing and Detailed Routing Global Routing – Problem formulation, Classification of global routing algorithms, Maze routing algorithms, Detailed Routing – Problem formulation, Classification of routing algorithms, Single layer routing algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concepts of various routing algorithms. (L3)
- Optimize the implemented design for area, timing and power by applying suitable constraints. (L4)

UNIT – V (10 Hrs)

Physical Design Automation of FPGAs and MCMs FPGA Technologies, Physical Design cycle for FPGAs, Partitioning, Routing – Routing Algorithm for the Non-Segmented model, Routing Algorithms for the Segmented Model; Introduction to MCM Technologies, MCM Physical Design Cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the fundamental concepts in CAD and to establish capability for CAD tool development and enhancement. (L2)
- Analyze the methodologies involved in design verification and implementation of digital designs on MCMs (Multi-Chip Modules). (L4)

TEXTBOOKS:

1. "Algorithms for VLSI Physical Design Automation", Naveed Shervani, 3rd Edition, 2005, Springer International Edition.
2. "CMOS Digital Integrated Circuits Analysis and Design", Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.

REFERENCE BOOKS:

1. "VLSI Physical Design Automation-Theory and Practice", Sadiq M Sait, Habib Youssef, World Scientific.
2. "Algorithms for VLSI Design Automation", S. H. Gerez, 1999, Wiley student Edition, John Wiley and Sons (Asia) Pvt. Ltd.
3. "VLSI Physical Design Automation", Sung Kyu Lim, Springer International Edition

Course Code	TEST AND TESTABILITY		L	T	P	C
21A04HN04			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand various faults associated with logic circuits and types of testing by employing fault models to the logic circuits.
- To study different methods of simulation and algorithms associated with testing.
- To get in-depth knowledge in different methods of simulation and algorithms associated with testing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand different types of faults associated with logic circuits and types of testing by employing fault models to the logic circuits. **(K2)**
CO2: Acquire verification knowledge and test evaluation. **(K5)**
CO3: Analyze the testability rules and techniques. **(K4)**
CO4: Acquire the knowledge of design of built-in-self test. **(K3)**
CO5: Utilize the scan architectures for different digital circuits. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	-	-	-	-	-	-	3	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	-	3
CO3	3	3	3	3	3	-	-	-	-	-	-	3	-	3
CO4	3	2	2	2	2	-	-	-	-	-	-	3	-	3
CO5	3	2	2	2	2	-	-	-	-	-	-	3	-	3

UNIT – I (10 Hrs)

Introduction to Testing: Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends affecting Testing, Types of Testing, Fault Modeling: Defects, Errors and Faults, Functional Versus Structural Testing, Levels of Fault Models, Single Stuck-at Fault.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different types of faults associated with logic circuits. (L2)
- Understand different types of testing by employing fault models to logic circuits. (L2)
- Study different types of defects and errors in the logic circuits. (L2)

UNIT – II (10 Hrs)

Logic and Fault Simulation: Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-value Simulation, Algorithms for Fault Simulation.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire verification knowledge of various faults in the logic circuits. (L3)
- Analyze the faults using simulation tools. (L4)
- Apply the algorithms for true value and fault simulation. (L3)

UNIT – III (10 Hrs)

Testability Measures: SCOAP Controllability and Observability, High Level Testability Measures, Digital DFT and Scan Design: Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan.

Learning Outcomes: At the end of this unit, students should be able to

- Define controllability and observability for a digital system. (L1)
- Identify schemes for introducing testability into digital circuits with improved fault coverage. (L3)
- Compare board level and chip level DFT approaches in testing. (L2)

UNIT – IV (10 Hrs)

Built-In Self-Test: The Economic Case for BIST, Random Logic BIST: Definitions, BIST Process, Pattern Generation, Response Compaction, Built-In Logic Block Observers, Test-Per-Clock, Test-Per-Scan BIST Systems, Circular Self Test Path System, Memory BIST, Delay Fault BIST.

Learning Outcomes: At the end of this unit, students should be able to

- Compare different BIST architectures. (L5)
- Perform memory test for the given memory block. (L3)
- Compare different approaches for introducing BIST into logic circuits, memories and embedded cores. (L5)

UNIT – V (10 Hrs)

Boundary Scan Standard: Motivation, System Configuration with Boundary Scan: TAP Controller and Port, Boundary Scan Test Instructions, Pin Constraints of the Standard, Boundary Scan Description Language: BDSL Description Components, Pin Descriptions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Boundary Scan Standard. (L2)
- Analyze the TAP and controller and port. (L4)
- Apply the Boundary Scan test for different digital circuits. (L3)

TEXTBOOKS:

1. “Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits”, M.L. Bushnell, V. D. Agrawal, Kluwer Academic Publishers.

2. “Digital Systems and Testable Design”, M. Abramovici, M.A.Breuer and A.D Friedman, Jaico Publishing House.

REFERENCE BOOKS:

1. “Digital Circuits Testing and Testability”, P.K. Lala, Academic Press.

COMPUTER SCIENCE AND ENGINEERING

(For the batches admitted from the academic year 2021-22)

Vision

- To be a recognized Centre in the field of Computer Science and Engineering by imparting quality education and also equipping the students with latest technologies, soft skills and ethical values to face the challenges in industry & society.

Mission

- To provide quality education by imparting state of the art facility in Computer Science and Engineering.
- Enrich the students with innovative and problem-solving skills by establishing continuous Industry Institute interaction.
- To prepare the learners possessing social commitment and ethical values to face the dynamic challenges of industry and society.

Institutional Objectives

- To create a conducive and competitive environment for students through curricular and extra-curricular activities.
- Promote the culture of research among the faculty.
- To promote synergetic alliances with premier Institutions, Industry, CSIR laboratories and various Government organizations for Collaborative Research Projects.
- To promote economic and social enrichment of the society through Skill Development programmes, Entrepreneurship and extension activities.
- To introduce demand-driven new UG&PG academic programmes.
- To ensure a high degree of quality in terms of providing infrastructure, research ambience, faculty and staff development.

Core Values

- *Thirst for Quality Education:* The stake holders of the institute particularly management, employees and students of the institution have a consistent thirst for quality improvement of the processes and services in the institution.
- *Lifelong Learning:* In the fast-changing technological world, acquiring a special skill at one point of time will not be enough for ever long survival. Hence to flourish in the work place and to bring in innovations in the ways of doing, employee, student as well as alumni must be continuous learners and tech savvy.

- *Diversity and Participation:* PBRVITS promotes the involvement of faculty, staff and students from all social, economic, ethnics, cultural and religious backgrounds to get the synergy of combining the diversified agents. The focus is on involving students to exhibit their talent in various curricular and co-curricular activities and strengthening alumni link to share their experiences to the students.
- *Academic Integrity and Accountability:* Management induces accountability in the employees for the career of the students and the academic leadership establishes a mentoring mechanism for realization of responsibilities of students towards their parents and in turn to the society.

COMPUTER SCIENCE AND ENGINEERING

(For the batches admitted from the academic year 2021-22)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept. / Branch & Innovations

Semester I (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110101	Calculus and Special Functions	3	0	0	3	30	70	100
2	BS	21A110105	Applied Chemistry	3	0	0	3	30	70	100
3	ES	21A050302	C-Programming & Data Structures	3	0	0	3	30	70	100
4	BS	21A110104	Applied Physics	3	0	0	3	30	70	100
5	HSMC	21A110202	English for Professionals	2	0	0	2	30	70	100
6	ES	21A050301	Engineering & IT Workshop	0	0	3	1.5	30	70	100
7	BS	21A110108A	Applied Physics Lab	0	0	3	1.5	30	70	100
8	BS	21A110108B	Applied Chemistry Lab	0	0	3	1.5	30	70	100
9	ES	21A050303	C-Programming & Data Structures Lab	0	0	3	1.5	30	70	100
Total							**20**			**900**

Semester II (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110102	Mathematical Methods	3	0	0	3	30	70	100
2	BS	21A110110	Probability and Statistics	3	0	0	3	30	70	100
3	ES	21A030301	Engineering Drawing	1	0	4	3	30	70	100
4	ES	21A050304	Advanced Data Structures through C++	3	0	0	3	30	70	100
5	ES	21A020303	Basic Electrical and Electronics Engineering	3	0	0	3	30	70	100
6	HSMC	21A110201	Communicative English Lab	0	0	2	1	30	70	100
7	ES	21A020304	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
8	ES	21A050305	Advanced Data Structures through C++ Lab	0	0	3	1.5	30	70	100
9	MC	21A000001	Environmental Science	2	0	0	0	30	--	--
Total							**19**			**800**

Semester III (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110111	Mathematical Foundations of Computer Science	3	0	0	3	30	70	100
2	PC	21A050401	Digital Logic Design & Computer Organization	3	0	0	3	30	70	100
3	PC	21A050402	Database Management Systems	3	0	0	3	30	70	100
4	PC	21A050403	Object Oriented Programming through Java	3	0	0	3	30	70	100
5	ES	21A050309	Micro Processors & Micro Controllers	3	0	0	3	30	70	100
6	PC	21A050404	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC	21A050405	Object Oriented Programming through Java Lab	0	0	3	1.5	30	70	100
8	ES	21A050308	Game Programming Lab	0	0	3	1.5	30	70	100
9	SC	21A050702	Graphics Design using Photoshop	1	0	2	2	30	70	100
10	MC	21A000002	Constitution of India	2	0	0	0	30	--	--
Total							**21.5**			**900**

Semester IV (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	ES	21A050306	Python Programming and Data science	3	0	0	3	30	70	100
2	PC	21A050407	Software Engineering & OOAD	3	0	0	3	30	70	100
3	PC	21A050408	Computer Networks	3	0	0	3	30	70	100
4	PC	21A050409	Operating Systems	3	0	0	3	30	70	100
5	HSMC	21A110203	Managerial Economics and Financial Analysis	3	0	0	3	30	70	100
6	ES	21A050307	Python Programming and Data science Lab	0	0	3	1.5	30	70	100
7	PC	21A050411	Software Engineering & OOAD Lab	0	0	3	1.5	30	70	100
8	PC	21A050412	Computer Networks & Operating Systems Lab	0	0	3	1.5	30	70	100
9	SC	21A050703	Advanced Java	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship-I (Community Service Project) during semester break										

Semester V (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050413	Theory of Computation	3	0	0	3	30	70	100
2	PC	21A050414	Software Testing	3	0	0	3	30	70	100
3	PC	21A050415	Design & Analysis of Algorithms	3	0	0	3	30	70	100
4	OE-I		**Open Elective - I**	3	0	0	3	30	70	100
5	PE-I	21A050416 21A050417 21A050418	**Professional Elective - I** a) Information Retrieval Systems b) SAP c) Mobile Computing	3	0	0	3	30	70	100
6	PC	21A050419	Software Testing Lab	0	0	3	1.5	30	70	100
7	PC	21A050420	Design & Analysis of Algorithms Lab	0	0	3	1.5	30	70	100
8	SC	21A050704	Amazon web services	1	0	2	2	30	70	100
9	MC	21A000003	Universal Human Values	3	0	0	3	30	70	100
10	PROJ	21A050601	Internship-I Evaluation	-	-	-	1.5	-	-	100
Total							**24.5**			**1000**

Semester VI (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050421	Artificial Intelligence	3	0	0	3	30	70	100
2	PC	21A050422	Mobile Application Development	3	0	0	3	30	70	100
3	PC	21A050423	Cloud Computing	3	0	0	3	30	70	100
4	PE-II	21A050424 21A050425 21A050426	**Professional Elective -II** a) Competitive Programming b) Software Project Management c) Soft Computing	3	0	0	3	30	70	100
5	OE-II		**Open Elective - II**	3	0	0	3	30	70	100
6	PC	21A050427	Mobile Application Development Lab	0	0	3	1.5	30	70	100
7	PC	21A050428	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
8	PC	21A050429	Cloud Computing Lab	0	0	3	1.5	30	70	100
9	SC	21A050705	Programming in C#	1	0	2	2	30	70	100
10	MC	21A000004	Research Methodology	2	0	0	0	30	---	---
Total							**21.5**			**900**
Internship-II (Industry) during semester break										

Semester VII (Fourth year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PE-III	21A050430 21A050431 21A050432	**Professional Elective -III** a) Machine Learning b) Big-Data Analytics using Hadoop c) Deep Learning	3	0	0	3	30	70	100
2	PE-IV	21A050433 21A050434 21A050435	**Professional Elective-IV** a) Cyber Security b) DevOps c) Design Patterns	3	0	0	3	30	70	100
3	PE-V	21A050436 21A050437 21A050438	**Professional Elective -V** a) Block Chain Technology b) Graphics & Multi Media Systems c) Storage Area Networks	3	0	0	3	30	70	100
4	OE-III		**Open Elective - III**	3	0	0	3	30	70	100
5	OE-IV		**Open Elective - IV**	3	0	0	3	30	70	100
6	HSMC	21A110204	Management Science	3	0	0	3	30	70	100
7	SC	21A050706	Hacking Tools	1	0	2	2	30	70	100
8	PROJ	21A050602	Internship-II Evaluation	-	-	-	3	--	--	100
Total							**23**			**800**

Semester VIII (Fourth Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PROJ	21A050603	Full Internship & Major Project	-	-	12	10	110	140	250
2	PROJ	21A050604	Technical Seminar	-	-	4	2	50	-	50
Total							**12**			**300**

Open Elective – I

S. No	Course Code	Course Title
1	21A010501	Air Pollution and Control
2	21A020501	Electric Vehicles
3	21A020502	Electrical Distribution Systems
4	21A030501	Robotics
5	21A030502	Basics of Mechanical Engineering
6	21A040501	Integrated Circuits and Applications
7	21A040502	Introduction to Signal Processing

Open Elective – II

S. No	Course Code	Course Title
1	21A010502	Environmental Pollution and Control
2	21A020503	Smart Grid
3	21A020504	Energy Storage Systems
4	21A030503	Automation in Industries
5	21A030504	Rapid Prototyping
6	21A040503	Principles of Communication Systems
7	21A040504	Electronic Instrumentation

Open Elective – III

S. No	Course Code	Course Title
1	21A010503	Disaster Management and Mitigation
2	21A020505	Renewable Energy Systems
3	21A020506	Concepts of Electrical Drives and Applications
4	21A030505	Optimization Techniques
5	21A030506	Global Warming and Climate Changes
6	21A040505	Electronic Sensors
7	21A040506	Introduction to Image Processing

Open Elective – IV

S. No	Course Code	Course Title
1	21A010504	Cost Effective Housing Techniques
2	21A020507	Energy Conservation and Management
3	21A020508	Basics of Power Electronics
4	21A030507	Basics of Automotive Engineering
5	21A030508	Basics of Total Quality Management
6	21A040507	Principles of Cellular and Mobile Communications
7	21A040508	Embedded Systems

COURSES OFFERED FOR HONOURS DEGREE IN CSE

S. No	Course Code	Course Title	Hours per week		Credits	CIE	SEE	Total
			L	T	C			
1	21A05HN01	Advanced Computer Networks	3	1	4	30	70	100
2	21A05HN02	Object Oriented Software Engineering	3	1	4	30	70	100
3	21A05HN03	Service Oriented Architecture	3	1	4	30	70	100
4	21A05HN04	Advanced Operating Systems	3	1	4	30	70	100
5	21A05HN05	MOOC – 1	-	-	2	-	-	-
6	21A05HN06	MOOC – 2	-	-	2	-	-	-

LIST OF MINORS OFFERED TO CSE

S. No	Course Code	Course Title	Department offering the course
1	21A040402	Pulse and Digital Circuits	ECE
2	21A040415	Data Communication and Networking	ECE
3	21A040433	Biomedical Signal Processing	ECE
4	21A040434	Radar Engineering	ECE

Course Code	CALCULUS AND SPECIAL FUNCTIONS (Common to all branches)		L	T	P	C
21A110101			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course will illuminate the students in the concepts of calculus and Mean value theorems.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Utilize mean value theorems to real life problems.
CO2: Familiarize with functions of several variables which is useful in optimization.
CO3: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems.
CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 3- dimensional coordinate systems.
CO5: Utilize special functions in evaluating definite integrals.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (10 Hrs)

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT – II (12 Hrs)

Multi variable calculus: Partial derivatives, total derivatives, chain rule, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes: At the end of this unit, students should be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

UNIT – III (10 Hrs)

Double Integrals: Evaluation of Double integrals, change of order of integration, change of variables. Areas using Double Integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

UNIT – IV (10 Hrs)

Triple Integrals: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volumes using triple integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate triple integrals in Cartesian, cylindrical and spherical polar coordinates. (L5)
- Apply triple integration techniques in evaluating volumes. (L4)

UNIT – V (12 Hrs)

Beta and Gamma functions: Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

TEXTBOOKS:

1. "Higher Engineering Mathematics", S. Grewal, Khanna Publishers, 44/e, 2017.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.

2. “Calculus”, George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
3. “Advanced Modern Engineering Mathematics”, Glyn James, Pearson publishers, 4/e, 2011.
4. “Advanced Engineering Mathematics”, Michael Greenberg, Pearson Education, 9th Edition.
5. “Advanced Engineering Mathematics with MATLAB”, Dean G. Duffy, CRC Press
6. “Advanced Engineering Mathematics”, Peter O’Neil, Cengage Learning.
7. “Engineering Mathematics Volumes-I &II”, R.L. Garg Nishu Gupta, Pearson Education
8. “Higher Engineering Mathematics”, B. V. Ramana, McGraw Hill Education
9. “Higher Engineering Mathematics”, H. K. Das, Er. Rajnish Verma, S. Chand & Co. Ltd.
10. “Advanced Engineering Mathematics”, N. Bali, M. Goyal, C. Watkins, Infinity Science Press.
11. “Engineering Mathematics”, T.K.V Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications.

Course Code	APPLIED CHEMISTRY (Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110105			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To familiarize Applied chemistry and applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods and applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the salient features of different theories along with their applications.
CO2: Discuss about the model engineering materials.
CO3: Apply the knowledge of various electrodes for the development of new batteries.
CO4: Identify the different polymers and their uses in various fields of engineering.
CO5: Analyze the knowledge of different analytical techniques used in engineering and also development of new techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	-

UNIT-I (14 Hrs)

Structure and Bonding Models: Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, Molecular orbital theory –bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, π-molecular orbital's of butadiene and benzene, calculation of bond order. Crystal field theory–salient features–splitting in octahedral and tetrahedral geometry.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Discuss the basic concept of molecular orbital theory (L3)
- Explain the calculation of bond order of O2 and Co molecules (L2)
- Discuss the salient features of Crystal field theory (L3)

UNIT-II (10 Hrs)

Modern Engineering Materials: Band theory of solids- band diagrams for conductors,

Insulators, Semiconductors, Effect of doping on band structures.
Super conductors and Super capacitors: Introduction, Definition, Classification, Applications.
Nano chemistry: Introduction, classification of nano materials, properties and applications of Fullerenes, carbon nanotubes and Graphene nanoparticles.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nanotubes and Graphenes nanoparticles (L2).

UNIT-III (13 Hrs)

Electro Chemistry and Applications: Electrodes and their concepts, Types of Reference electrodes-their applications. Electrochemical cell, Nernst equation, Numerical problems on emf.

Primary cells – Zinc-air battery, Secondary cells – Lead-acid and Lithium-ion batteries-working of the batteries including cell reactions; Fuel cells- hydrogen-oxygen, methanol- oxygen fuel cells – working of the cells.

Potentiometry- principle, potentiometric titrations (redox titrations), Conductometry-conductometric titrations (acid-base titrations).

Electrochemical sensors– potentiometric sensors principle with examples, ampere metric sensors principle with examples and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)

UNIT-IV (13 Hrs)

Polymer Chemistry: Introduction to polymers, functionality of monomers and their significance, Tacticity of polymers, Types of polymerization- chain growth, step growth and copolymerization with specific examples and mechanisms of polymer formation.

Plastomers-Thermoplastics and Thermo setting plastics, Preparation, properties and applications of– PVC, Teflon, Bakelite, Nylons.

Elastomers – Buna-S, Buna-N– preparation, properties and applications of Buna-S, Buna-N.

Conducting polymers, examples, classification, polyacetylene, polyaniline - mechanism of conduction and applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylons (L2)
- Describe the mechanism of conduction in conducting polymers (L2)
- Discuss Buna-S and Buna-N and their applications (L2)

UNIT-V (10 Hrs)

Instrumental Methods and Applications: Introduction, Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law- Principle, instrumentation and applications of UV-Visible**,** IR-Spectroscopy's and pH-metry, Solid-Liquid Chromatography–TLC, retention factor.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles and applications of different analytical instruments (L2)

TEXTBOOKS:

1. "Engineering Chemistry", Jain and Jain, Dhanpat Rai publications, 17/e, 2018
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014
3. "Principles of Instrumental Analysis", Skoog, FJ Holler and SR Crouch, 7/e, 2018
4. "Applied Chemistry", Guesser, Springer's Publications, 2001
5. "Atkins' Physical Chemistry", Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 10/e, 2010

REFERENCE BOOKS:

1. "Concise Inorganic Chemistry", J. D. Lee, Oxford University Press, 5/e, 2008
2. "Engineering Chemistry", G. V. Subba Reddy, K. N. Jayaveera and Ramachandraiah, McGraw Hill, 2020.

Course Code	C-PROGRAMMING & DATA STRUCTURES (Common to all branches)		L	T	P	C
21A050302			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- Demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C using Arrays and Strings.
CO3: Modularize the problem and also solution.
CO4: Design applications in C using Functions, Pointers, and Structures.
CO5: Explore various operations on Stacks, Queues and Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Computer Fundamentals, Algorithm, Flowchart.

Introduction to C Language: Characteristics, Identifiers, Constants, Data types, Keywords, Basic input/output statements, Structure of a C program.

Operators and Expressions: Operators classification, Assignment Operator, Arithmetic Operators, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators with examples – Operator precedence and Associativity, Type casting.

Statements: Simple and Compound statements, Control Statements - Conditional/Decision statements, Loop Control Statements, Branch Control statements.

Learning Outcomes: At the end of this unit, students should be able to

- Solve complex problems using language independent notations (L3)
- Use C basic concepts to write simple C programs (L3)
- Test and execute the programs and correct syntax and logical errors (L4)
- Select the control structure for solving the problem (L4)
- Implement conditional branching, iterations (L2)

UNIT-II (12 Hrs)

Arrays: Declarations, Initialization and accessing elements, Single, Two and Multi-dimensional arrays.

Array Techniques: Array order reversal, finding the maximum and minimum number in a set, sorting the given array elements.

Strings: String I/O functions, String handling functions, Data conversion functions.

Learning Outcomes: At the end of this unit, students should be able to

- Use arrays to process multiple homogeneous data (L3)
- Solve mathematical problems using C Programming languages (L3)
- Apply string handling functions (L3)

UNIT-III (12 Hrs)

Functions: Types of functions, Library functions, User-defined functions, Function Categories, Nested functions, Recursion, Symbolic constants, Pre-processor Commands, Storage classes – auto, register, static, extern, Type qualifiers.

Input and output: Standard input and output, Non-formatted Input and Output statements, Formatted Input and Output statements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of modular programming (L2)
- Apply modular approach for solving the problem (L3)
- Writing C programs using various storage classes to control variable access (L5)
- Apply input and output statements to process the data in various formats (L3)

UNIT-IV (12 Hrs)

Pointers: Pointers and addresses, Passing parameters to functions, Address Arithmetic operations, Void and Null pointers, Pointer and Arrays, Pointer and Strings, Array of Pointers, Pointer and Functions, Pointer-to-Pointer, Dynamic Memory Allocation. Uses of Pointers, Command line Arguments.

Structure and Union: Declaration and Initialization of a structure, Copy and comparisons, Array of structures, Structure with pointer, Nested structures, Type Definition, Enumeration, Union.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Structure the individual data elements to simplify the solutions (L6)
- Facilitate efficient memory utilization (L6)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT-V (14 Hrs)

Data Structures: Overview of data structures, **Stack:** Representation of a stack, Operations and Applications of a Stack – Evaluation of Arithmetic Expressions, Implementation of Recursion – **Queue:** Representation of a queue, Operations and Applications of a Queue – CPU Scheduling in Multi-programming Environment.

Linked List: Representations of linked lists, singly linked list, doubly linked list, Circular linked list and its operations.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Describe the operations of a stack (L2)
- Develop various operations on Queues (L6)
- Analyze various operations on singly linked list (L4)
- Interpret operations of doubly linked lists (L2)
- Apply various operations on Circular linked lists (L6)

TEXTBOOKS:

1. "The Complete Reference C", Herbert Schildt, McGraw Hill Education, Fourth Edition
2. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
3. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition
2. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

Course Code	APPLIED PHYSICS (Common to EEE, ECE & CSE)		L	T	P	C
21A110104			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To identify the importance of the physical optics i.e., interference, diffraction and polarization related to its engineering applications
- To understand the mechanisms of lasers and propagation of light through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging microdevices.
- To present the basic concepts needed to understand the crystal structure of materials, X- ray diffraction and the importance of nano materials.
- Evolution of band theory to distinguish materials and explain the properties of semiconductors and superconductors.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze the differences between interference, diffraction & polarization with applications.
CO2: Identify the importance of lasers and fiber optics in different engineering fields
CO3: Understands the response of dielectric & magnetic materials to the applied electric & magnetic fields
CO4: Explain the important properties of crystals & structure determination using X-ray diffraction along withthe nano materials.
CO5: Elaborate the physical properties of semiconductors and superconductors

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-

UNIT – I (13 Hrs)

Wave Optics Interference- Principle of superposition – Interference of light – Conditions for sustained interference - Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit – Grating spectrum.

Polarization- Introduction – Types of polarization – Polarization by double refraction- Nicol's

Prism - Half wave and Quarter wave plates with applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the need of coherent sources and the conditions for sustained interference (L2)
- Identify engineering applications of interference (L3)
- Analyze the differences between interference and diffraction with applications (L4)
- Illustrate the concept of polarization of light and its applications (L2)
- Classify ordinary polarized light and extraordinary polarized light (L2)

UNIT – II (12 Hrs)

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Transmission of Signals in Step index and graded index fiber – Propagation Losses (qualitative) – Block diagram of Fiber Optics Communication System- Applications of Fibers in medical field.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

UNIT – III (12 Hrs)

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Learning Outcomes*:* At the end of this unit, students should be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius- Mosotti relation in dielectrics (L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
- Explain the applications of dielectric and magnetic materials (L2)

UNIT – IV (12 Hrs)

Crystallography: Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Laue method - Powder method.

Nano materials – Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nano materials.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Classify various crystal systems (L2)
- Identify different planes in the crystal structure (L3)
- Analyze the crystalline structure by Bragg's law to measure the crystallinity of a solid by powder method (L4)
- Identify the nano size dependent properties of nanomaterials (L2)
- Illustrate the methods for the synthesis and characterization of nanomaterials (L2)
- Apply the basic properties of nanomaterials in various Engineering branches (L3)

UNIT – V (12 Hrs)

Semiconductors and Superconductors

Semiconductors- Origin of energy bands - Classification of solids into conductors, semiconductors and insulators -Intrinsic and extrinsic semiconductors (Qualitative treatment)– Density of carriers and Fermi levels in intrinsic & extrinsic semiconductors - Drift& diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) – High T_c superconductors – Applications of super conductors.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)
- Explain how electrical resistivity of solids changes with temperature (L2)
- Classify superconductors based on Meissner's effect (L2)
- Explain Meissner's effect, BCS theory & Josephson effect in superconductors (L2)

TEXTBOOKS:

1. "Engineering Physics", Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, S. Chand and Company
2. "Engineering Physics", B.K. Pandey and S. Chaturvedi, Cengage Learning.

3. "Engineering Physics", K. Thyagarajan, McGraw Hill Publishers

REFERENCE BOOKS:

1. "Engineering Physics", Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. "Engineering Physics", Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
3. "Semiconductor physics and devices - Basic principles", Donald A, Neamen, McGraw Hill
4. "Engineering physics", P.K. Palanisamy, SCITECH Publications
5. "Applied Physics", S. Mani Naidu, Pearson Publications
6. "Lasers and Non-Linear Optics", B.B Laud, New Age International Publishers.

Course Code	ENGLISH FOR PROFESSIONALS		L	T	P	C
21A110202	(Common to all branches)		**2**	**0**	**0**	**2**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To improve Reading and Writing proficiency of students in English with an emphasis on Vocabulary development.
- To provide knowledge of grammatical structures and encourage their appropriate use in writing.
- To improve students' comprehension skills required for academic and professional needs.
- To equip students with writing skills required for professional correspondence in different contexts.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate word knowledge and its usage in appropriate contexts.
CO2: Recognize and incorporate basic grammar mechanics and sentence variety in writing.
CO3: Improve comprehension skills through intensive and extensive reading practice.
CO4: Learn and apply various writing formats for effective communication.
CO5: Improve writing skills needed for professional correspondence in various contexts.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

UNIT-I (10 Hrs)

Vocabulary Building: Introduction to affixes and base words, Prefixes and suffixes, Basic comparing and contrasting, Idioms and Phrases, One word substitutes, Words often confused, Synonyms and Antonyms used in the everyday contexts, Using prior knowledge to determine the correct word for the context, Discovering the correct word in the sentence by looking at the surrounding words, Vocabulary in social interactions.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize word parts: affixes, prefixes, suffixes and base words. (L2)
- Use words appropriately in a context. (L3)
- Guess the meanings of the words by using the contextual clues. (L2)
- Use synonyms, antonyms, phrases and idioms in writing. (L2)

UNIT-II (10 Hrs)

Essentials of Sentence Formation: Basic Sentence Structure, word order, Subject-Verb Concord, Using Tenses, Punctuation Marks, Correction of Common Errors

Learning Outcomes: At the end of this unit, students should be able to

- Frame a sentence without any grammatical errors. (L3)
- Use appropriate punctuation marks. (L3)
- Identify common errors in a sentence. (L2)

UNIT-III (10 Hrs)

Reading Comprehension: Understanding short real world notices, messages, factual material - Scanning, skimming - Inferring meaning - Critical reading - Reading and information transfer

Learning Outcomes: At the end of this unit, students should be able to

- Use skimming and scanning strategies while reading. (L3)
- Infer meaning from the given text. (L3)
- Distinguish between the main idea and supporting ideas. (L3)
- Critically analyse the given text. (L4)

UNIT-IV (10 Hrs)

Writing Skills: Rules for good writing and composition; Paragraph Writing: Structure of a paragraph, Types of paragraphs, Usage of Cohesive Devices; Essay writing: Structure of an Essay, Types of Essays; Letter Writing (Formal and informal): Format and Structure; and Email writing

Learning Outcomes: At the end of this unit, students should be able to

- Learn to organize thoughts into meaningful paragraphs. (L2)
- Use cohesive devices in making the piece of writing more coherent. (L3)
- Compose essays on different topics in a more organised structure. (L3)
- Draft letter and emails in a definite format. (L3)

UNIT-V (10 Hrs)

Professional Correspondence: Internal Correspondences – Memorandum, Note Taking, Minutes of Meetings; External Correspondences - Business Letters - Cover Letters - Sale Letters - Inquiry Letters - Complaint Letters - Emails & Netiquette

Learning Outcomes: At the end of this unit, students should be able to

- Draft official e-mails and letters for different professional purposes. (L3)
- Write proficiently memos and minutes of meeting. (L3)

TEXTBOOKS:

1. “Technical Communication – Principles and Practice”, Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://digital.library.upenn.edu/women/sultana/dream/dream.html
2. https://owl.purdue.edu/
3. https://www.thesaurus.com/
4. https://www.readwritethink.org/classroom-resources/student-interactives
5. https://www.fluentu.com/blog/english/english-writing-websites/

Course Code	ENGINEERING & IT WORKSHOP LAB		L	T	P	C
21A050301	(Common to all branches)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

PART-A (ENGINEERING WORKSHOP)

COURSE OBJECTIVES:

- To familiarize the students with wood working, sheet metal operations, fitting and electrical house, Wiring and foundry skills.
- To provide technical training to the students on Word, Excel and Presentation.
- To make the students know about the internal parts of a computer.
- To learn how to use Internet facility for Browsing and Searching.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply wood working skills and build different parts with metal sheets in real world applications.
CO2: Apply fitting operations in various applications and Preparation of moulds and castings.
CO3: Apply different types of basic electric circuit connections.
CO4: Prepare documentation, spread sheets for calculations and slides for Presentation.
CO5: Identify Computer peripherals and its functions, Internet browsing to obtain the required information

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	1	-
CO2	3	2	2	-	-	2	-	-	-	-	-	2	1	-
CO3	3	2	-	-	-	2	-	-	-	-	-	2	1	2
CO4	3	-	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

LIST OF TOPICS:

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint b) Dovetail joint or Bridle joint

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Square fit.

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting

Foundry:

a) Preparation of mould cavity using single piece pattern.
b) Preparation of mould cavity using split piece pattern

PART-B (IT WORKSHOP)

LIST OF TOPICS:

Task 1:

MS-Word: Students should be able to create documents using the word processor tool. Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit report.

Task 2:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 3:

Presentations: creating, opening, saving the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, running the slide show.

Task 4: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 5:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.

REFERENCE BOOKS:

1. "Workshop Practice Manual", K. Venkata Reddy, BS Publications.
2. "Engineering work shop practice for JNTU", V. Ramesh babu, VRB Publishers Pvt. Ltd., 2009.
3. "Work shop manual", P. Kannaiah, K. L. Narayana, SCITECH Publishers.
4. "Engineering practices lab manual", Jeyapoovan, Saravanapandian, Vikas Publishing House, 4/E
5. "Dictionary of mechanical engineering", GHF Nayler, Jaico Publishing House.
6. "Introduction to Computers", Peter Norton, McGraw Hill
7. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox.
8. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
9. "Networking your computers and devices", Rusen, Prentice Hall of India
10. "Bigelow's Trouble shooting, Maintaining & Repairing PCs", Bigelow, Tata McGraw Hill Edition

Course Code	APPLIED PHYSICS LAB (Common to EEE, ECE & CSE)		L	T	P	C
21A110108A			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Understands the concepts of interference, diffraction, and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity in semiconductors
- Will recognize the applications of laser in finding the wavelength in diffraction studies

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Operate optical instruments like microscope and spectrometer.
CO2: Determine thickness of a hair/paper with the concept of interference.
CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.
CO4: Evaluate the acceptance angle of an optical fiber and numerical aperture.
CO5: Determine the resistivity of the given semiconductor using four probe method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO2	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO3	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO4	3	2	-	-	-	-	-	-	1	1	-	-	-	-
CO5	3	2	-	-	-	-	-	-	1	1	-	-	-	-

LIST OF EXPERIMENTS

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of wavelength of LASER light using diffraction grating.
5. Determination of numerical aperture and acceptance angle of a given optical fiber.
6. Magnetic field along the axis of a circular coil carrying current–Stewart Gee's method.
7. Determination of the resistivity of semiconductor by Four probe method.
8. Determination of particle size using LASER.
9. Study the variation of B versus H by magnetizing the magnetic material. (B-H curve)
10. Determination of Dispersive power of prism.

REFERENCE BOOKS:

1. "A Textbook of Practical Physics", S. Balasubramanian, M.N. Srinivasan, S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Code	APPLIED CHEMISTRY LAB		L	T	P	C
21A110108B	(Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of Chemistry
- To verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Distinguish different types of titrations in the volumetric analysis
CO2: Determine the cell constant and conductance of solutions
CO3: Measure the strength of an acid present in secondary batteries
CO4: Analyze the effect of absorbance of given sample solution on concentration by using colorimetry.
CO5: Prepare advanced polymer Bakelite materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-		-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Preparation of Standard Oxalic acid solution
2. Determination of Strength of an acid in Lead- Acid battery
3. Estimation of Ferrous Iron by Dichrometry
4. Potentiometry - Determination of redox potentials and emfs
5. Conductometry - Determination of cell constant and conductance of solutions.
6. Conductometric titration of a) strong acid vs strong base b) weak acid vs strong base.
7. P^H-metric titration of a) strong acid vs strong base b) weak acid vs strong base.
8. Verification of the Beer-Lambert's law and determination of strength of the given unknown solution.
9. Determination of the Retention factor of the sample by Thin Layer Chromatography (TLC).
10. Measurement of 10Dq by spectrophotometric method.
11. Preparation of Bakelite and measurement of its mechanical properties (strength)

12. Preparation of nanomaterials.

TEXTBOOKS:

1. "A Text Book on Experiments and Calculations in Engineering Chemistry", S. Chand Publications, 9/e, 2003.
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014.
3. "Experiments in Applied Chemistry", Dr. Sunita Rattan, S. K. Kataria & Sons Publishers of Engineering, 2/e, 2004.

REFERENCE BOOKS:

1. "Vogel's Text Book of Quantitative Chemical Analysis", Mendham J et.al, Pearson Education, 6/e, 2012.

Course Code	C-PROGRAMMING & DATA STRUCTURES LAB (Common to all branches)		L	T	P	C
21A050303			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of C Programming
- To make the student solve problems, implement algorithms using C language
- To design programs using arrays, strings, pointers and structures
- To design Stack and Queue operations
- To apply different operations on linked lists

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Demonstrate the basic concepts of C programming language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs using functions, arrays, structures and pointers.
CO4: Illustrate the concepts Stacks and Queues.
CO5: Design operations on Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

Week 1

a) Write a C program to swap the given two integer values without using temporary variable.
b) Write a C program to print the first ‘N’ Fibonacci sequence numbers.

Week 2

a) Write a C program to print reverse of a given integer value.
b) Write a C program to find the roots of a quadratic equation.

Week 3

Write a C program that use recursive functions.

i) GCD of given two values.
ii) Factorial of a given value.

Week 4

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program to perform the following:

i) Addition of Two matrices ii) Multiplication of Two matrices

Week 5

a) Write a C program that displays the position or index in the string S where the string T begins or -1 if S doesn't contain T.

b) Write a C program to read a set of strings and sort them in alphabetical order.

Week 6

a) Write a C program to count number of alphabets, digits and special symbols of a given line.

b) Write a C program to check whether a given string is palindrome or not.

Week 7

Write a C program to demonstrate the difference between call-by-value and call-by-address mechanisms.

Week 8

Write a program to perform the operations addition, subtraction, multiplication of complex numbers.

Week 9

Write a C program that implement stack operations using arrays.

Week 10

a) Write a C program that implement linear queue operations using arrays.

b) Write a C program that implement circular queue operations using arrays.

Week 11

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on doubly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following operations on circular linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

TEXTBOOKS:

1. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
2. "Computer Science: A Structured Programming Approach Using C", B.A. Forouzon and R.F. Gilberg, CENGAGE Learning, Third Edition, 2016.
3. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition,
2. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.

<table>
<tr><td>Course Code</td><td rowspan="2">MATHEMATICAL METHODS
(Common to all branches)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A110102</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">II</td></tr>
</table>

COURSE OBJECTIVES:

- This course aims at providing use of matrix algebra techniques for practical applications.
- This course aims at providing the student with the knowledge on Various numerical Methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop the use of matrix algebra techniques that is needed by engineers for practical applications.

CO2: Understand and solve the roots of equation using Bisection method, Iterative method, Regula-Falsi method, Newton Raphson method and solve the system of algebraic equations.

CO3: Apply concept of interpolation and derive interpolating polynomial using Newton's forward and backward formulae, Lagrange's formulae, Gauss forward and backward formulae.

CO4: Solving initial value problems to ordinary differential equations.

CO5: Determine the process of finding integral equations using Simson's 1/3, Simson's 3/8 Rule and Trapezoidal rule and fitting a best curve using least squares method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1	-

UNIT- I (10 Hrs)

Matrices: Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their Properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Diagonalization of a matrix.

Learning Outcomes: At the end of this unit, students should be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT - II (10 Hrs)

Solution of Algebraic & Transcendental Equations: Introduction-Bisection method-Iterative method-Regula-Falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan Method-Gauss Seidal method.

Learning Outcomes: At the end of this unit, students should be able to

- Calculate the roots of equation using Bisection method and Iterative method. (L3)
- Calculate the roots of equation using Regula-Falsi method and Newton Raphson method. (L3)
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Seidal method. (L3)

UNIT - III (10 Hrs)

Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of interpolation. (L2)
- Derive interpolating polynomial using Newton's forward and backward formulae. (L3)
- Derive interpolating polynomial using Lagrange's formulae. (L3)
- Derive interpolating polynomial using Gauss forward and backward formulae. (L3)

UNIT - IV (12 Hrs)

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations- Euler's Method - Modified Euler's Method- Runge-Kutta Methods.

Learning Outcomes: At the end of this unit, students should be able to

- Solve initial value problems to ordinary differential equations using Taylor's method. (L3)
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods. (L3)

UNIT - V (12 Hrs)

Numerical Integration & Curve Fitting:

Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Fitting of straight line – second degree curve –Exponential curve –Power curve by the method of least squares.

Learning Outcomes: At the end of this unit, students should be able to

- Fit a best curve using method of least squares. (L3)
- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule. (L3)
- Solve integral equations using Trapezoidal rule. (L3)

TEXTBOOKS:

1. “Higher Engineering Mathematics”, B. S. Grewal, Khanna publishers.
2. “Advanced Engineering Mathematics”, Erwin Kreyszig, Wiley India
3. “Introductory Methods of Numerical Analysis”, S. S. Sastry, PHI publishers.

REFERENCE BOOKS:

1. “Higher Engineering Mathematics”, B. V. Ramana, Mc Graw Hill publishers.
2. “Advanced Engineering Mathematics”, Alan Jeffrey, Elsevier Publishers
3. “A Text Book of Engineering Mathematics Vol – I”, T.K.V. Iyengar, B. Krishna Gandhi, S. Chand & Company.

Course Code	PROBABILITY AND STATISTICS (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110110			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize the students with the foundations of probability and statistical methods.
- To impart probability concepts and statistical methods in various applications Engineering.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Solve the central tendency, correlation and correlation coefficient and regression.
CO2: Understand the terminologies of basic probability, two types of random variables and their probability functions.
CO3: Interpret the behavior of various discrete and continuous probability distributions.
CO4: Apply the concept of hypothesis testing for large samples.
CO5: Apply the statistics for testing the significance of the given small sample data by using t- test, F- test and Chi-square test.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	3	-	-	-	-	-	1	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Statistics Introduction, Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, regression lines, regression coefficients and their properties

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the basic concepts of data science and its importance in engineering (L2)
- Analyze the data quantitatively or categorically, measure of averages, variability (L4)
- Adopt correlation methods and regression analysis (L5)

UNIT-II (11 Hrs)

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Bayes theorem, random variables (discrete and continuous), probability density functions, properties.

Learning Outcomes: At the end of this unit, students should be able to

- Define the terms trial, events, sample space, probability, and laws of probability (L1)
- Make use of probabilities of events in finite sample spaces from experiments (L3)
- Apply Bayes theorem to real time problems (L3)
- Explain the notion of random variable, distribution functions and expected value (L2)

UNIT-III (12 Hrs)

Probability distributions: Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (L3)
- Interpret the properties of normal distribution and its applications (L2)

UNIT-IV (11 Hrs)

Estimation and Testing of hypothesis, large sample tests: Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of estimation, interval estimation and confidence intervals (L2)
- Apply the concept of hypothesis testing for large samples (L4)

UNIT-V (11 Hrs)

Small sample tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the concept of testing hypothesis for small samples to draw the inferences (L3)
- Estimate the goodness of fit (L5)

TEXTBOOKS:

1. "Miller and Freund's Probability and Statistics for Engineers", Richard A. Johnson, Pearson, 7/e, 2008.
2. "Fundamentals of Mathematical Statistics", S.C. Gupta and V.K. Kapoor, S. Chand & Sons Publications, 11/e, 2012.

REFERENCE BOOKS:

1. "A First Course in Probability", S. Ross, Pearson Education India, 2002.
2. "An Introduction to Probability Theory and its Applications", W. Feller, Wiley Publications, 1/e, 1968.
3. "Probability, Random Variables & Random Signal Principles", Peyton Z. Peebles, McGraw Hill Education, 4/e, 2001.

Course Code	ENGINEERING DRAWING (Common to all branches)		L	T	P	C
21A030301			1	0	4	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.
- Instruct graphical representation of machine components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Construction of various conic curves, Cycloid curves
CO2: Construction of projections of Points, Lines applied in engineering
CO3: Construction of projections of Planes.
CO4: Construction of projection of solids development of surfaces regular Solids.
CO5: Representation of Ortho and Isometric views of solids.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO4	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO5	3	2	2	-	3	-	-	-	-	2	-	2	2	2

UNIT-I (12 Hrs)

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance - Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, Epi-cycloid and Hypocycloid - general method only.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of engineering drawing (L2)
- Know the conventions used in the engineering drawing (L1)
- Identify the curves obtained in different conic sections (L2)
- Draw different cycloidal curves. (L3)

UNIT– II (12 Hrs)

Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, true angle made by line.

Learning Outcomes: At the end of this unit, students should be able to

- Know how to draw the projections of points, lines (L1)
- Find the true length of the lines. (L2)

UNIT-III (18 Hrs)

Projection of planes: Projections of regular plane inclined to both the planes and also draw the projections of different planes in Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of planes. (L2)
- Draw the projection of plane inclined to one plane and both the planes. (L3)
- Understand the different commands used in Computerized drawing to draw different planes. (L2)

UNIT- IV (15 Hrs)

Projections of solids: Projections of regular solids inclined to one or both planes by rotational method.

Development of Solids: Development of lateral Surfaces of Right Regular Solids (without section)-Prism, Cylinder, Pyramid, Cone.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of solids. (L2)
- Draw the projection of solid inclined to one plane. (L3)
- Draw the projection of solids inclined to both the planes. (L3)

UNIT–V (18 Hrs)

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Conversion of Isometric Views to Orthographic Views. Drawing the Isometric views using Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the basics convectional representation of different projections (L1)
- Draw the Orthographic projection of simple solids. (L3)
- Draw the Isometric projection of simple solids. (L3)

TEXTBOOKS:

1. “Engineering Drawing”, K. L. Narayana & P. Kannaiah, SciTech Publishers, Chennai, 3/e.

2. "Engineering Drawing + AutoCAD", K. Venugopal, V. Prabhu Raja, New Age Publishers.
3. "Engineering Drawing", N. D. Bhatt, Charotar Publishers, 53/e, 2016

REFERENCE BOOKS:

1. "Engineering Drawing", Dhanajay A Jolhe, Tata McGraw-Hill, Copy Right, 2009.
2. "Engineering Drawing", Basant Agarwal & C. M. Agarwal, Tata McGraw-Hill
3. "Engineering Drawing", Shah and Rana, Pearson Education, 2/e, 2009

Course Code	ADVANCED DATA STRUCTURES THROUGH C++ (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050304			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	II			

COURSE OBJECTIVES:

- To be familiar with basic techniques of object-oriented principles and exception handling using C++
- To be familiar with the concepts like Inheritance, Polymorphism
- Solve problems using data structures such as linear lists, stacks, queues

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Distinguish between procedures and object-oriented programming.
CO2: Apply advanced data structure strategies for exploring complex data structures.
CO3: Compare and contrast various data structures and design techniques in the area of Performance.
CO4: Implement data structure algorithms through C++.
CO5: Incorporate data structures into the applications such as binary search trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

UNIT-1 (13 Hrs)

ARRAYS: Abstract Data Types and the C++ Class, An Introduction to C++ Class- Data Abstraction and Encapsulation in C++- Declaring Class Objects and Invoking Member Functions- Special Class Operations- Miscellaneous Topics- ADTs and C++Classes, The Array as an Abstract Data Type, The Polynomial Abstract Data type- Polynomial Representation- Polynomial Addition. Spares Matrices.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about OOPS concepts (L3).
- Learn and solve about different types of Class Types and Polynomial representation (L3)

UNIT- II (10 Hrs)

STACKS AND QUEUES: Templates in C++, Template Functions- Using Templates to Represent Container Classes, The Stack Abstract Data Type, The Queue Abstract Data Type, Subtyping and Inheritance in C++, Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as Templates in C++ (L3)
- Analyze the behaviour of different types of Classes, ADT and Expressions (L3)

UNIT – III (12 Hrs)

LINKED LISTS – I: Single Linked List and Chains, Representing Chains in C++, Defining a Node in C++- Designing a Chain Class in C++- Pointer manipulation in C++- Chain Manipulation Operations, The Template Class Chain, Implementing Chains with Templates- Chain Iterators- Chain Operations- Reusing a Class, Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials,

Learning Outcomes: At the end of this unit, students should be able to

- Learn and implement different types of Linked Lists (L3)
- Acquire the Knowledge of functions of Templates in C++ (L1)
- Implement Chain Iterators and Polynomials (L3)

UNIT – IV (13 Hrs)

LINKED LISTS – II: Polynomial Representation- Adding Polynomials- Circular List Representation of Polynomials, Equivalence Classes, Sparse Matrices, Sparse Matrix Representation- Sparse Matrix Input- Deleting a Sparse Matrix, Doubly Linked Lists, Generalized Lists, Representation of Generalized Lists- Recursive Algorithms for Lists Reference Counts, Shared and Recursive Lists

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables using Polynomial Representation (L5)
- Apply Matrix techniques in evaluating different types (L4)
- Evaluating Generalized Lists and Recursive algorithms (L5)

UNIT-V (12 Hrs)

TREES: Introduction, Terminology, Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Tress, Binary Tree Representations, Binary Tree Traversal and Tree Iterators, Introduction, Inorder Traversal Preorder Traversal, Postorder Traversal, Thread Binary Trees, Threads, Inorder Traversal of a Threaded Binary Tree, Inserting a Node into a Threaded Binary Tree, Heaps, Priority Queues, Definition of a Max Heap, Insertion into a Max Heap, Deletion from a Max Heap, Binary Search Trees, Definition, Searching a Binary Search Tree, Insertion into a Binary Search Tree, Deletion from a Binary Search Tree, Height of Binary Search Tree.

Learning Outcomes: At the end of this unit, the student will be able to

- Understand Tree functions and its relations (L2)
- Conclude the use of different types of Trees representation (L4)

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2nd edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2nd edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3rd Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W.Savitch, Pearson education, Fourth edition

<table>
<tr><th>Course Code</th><th rowspan="2" colspan="2">BASIC ELECTRICAL & ELECTRONICS ENGINEERING
(Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)</th><th>L</th><th>T</th><th>P</th><th>C</th></tr>
<tr><td>21A020303</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">II</td></tr>
</table>

COURSE OBJECTIVES:

- To teach DC and AC electrical circuit analysis
- To explain working principles of transformers and electrical machines
- To impart knowledge on Power system generation, transmission and distribution
- Familiar with the theory, construction, and operation of electronic devices
- Learn about biasing of BJTs and FETs.
- Design and construct amplifiers, understand the concept & principles of logic devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply concepts of KVL/KCL in solving DC circuits
CO2: Illustrate working principles of DC Motor, Transformer and Induction motors
CO3: Understand the basics of Power generation, Transmission and Distribution
CO4: Explain the theory, construction, operation and working of electronic devices.
CO5: Analyze and design small signal amplifier circuits, logic gate, combinational and sequential circuits

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

Part A: Basic Electrical Engineering

UNIT-I (10 Hrs)

DC & AC Circuits: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms -peak and rms values - phasor representation - real power - reactive power - apparent power – power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

Learning Outcomes: At the end of this unit, students should be able to

- Recall Kirchoff laws (L1)
- Analyze simple electric circuits with DC excitation (L4)

- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations (L4)

UNIT-II (10 Hrs)
DC & AC Machines: Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator –principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single-Phase Transformer - OC and SC tests on transformer -Principle and operation of 3-phase AC machines [Elementary treatment only]
Learning Outcomes: At the end of this unit, students should be able to

- Explain principle and operation of DC Generator & Motor. (L2)
- Perform speed control of DC Motor (L3)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor - DC motor (L2)

UNIT-III (10 Hrs)
Basics of Power Systems: Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary& Secondary distribution systems.
Learning Outcomes: At the end of this unit, students should be able to

- Understand working operation of various generating stations (L1)
- Explain the types of Transmission and Distribution systems (L2)

TEXTBOOKS:

1. "Basic Electrical Engineering", D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2010.
2. "Principles of Power System", V.K. Mehta & Rohit Mehta, S. Chand, 2018.

REFERENCE BOOKS:

1. "Fundamentals of Electrical Engineering", L. S. Bobrow, Oxford University Press, 2011.
2. "Electrical and Electronics Technology", E. Hughes, Pearson, 2010.
3. "Generation Distribution and Utilization of Electrical Energy", C.L. Wadhwa, New Age International Publications, 3rd Edition.

Part 'B'- Electronics Engineering

UNIT-I (10 Hrs)
Diodes and Applications: Semiconductor Diode, Diode as a Switch& Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications of Zener Diode, LED, Photo Diode.

Transistor Characteristics: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Biasing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

Learning Outcomes: At the end of this unit, students should be able to

- Remember and understand the basic characteristics of semiconductor diode. (L1)
- Understand principle of operation of Zener diode and other special semiconductor diodes (L1)
- Analyze BJT based biasing circuits. (L3)
- Design an amplifier using BJT based on the given specifications. (L4)

UNIT-II (10 Hrs)

Operational Amplifiers and Applications: Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

Learning Outcomes: At the end of this unit, students should be able to

- Describe operation of Op-Amp based linear application circuits, converters, amplifiers and non-linear circuits. (L2)
- Analyze Op-Amp based comparator, differentiator and integrator circuits. (L3)

UNIT-III (10 Hrs)

Digital Electronics: Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder. Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the functionality of logic gates. (L2)
- Apply basic laws and De Morgan’s theorems to simplify Boolean expressions. (L3)
- Analyze standard combinational and sequential circuits. (L4)

TEXTBOOKS:

1. “Electronic Devices & Circuit Theory”, R. L. Boylestad & Louis Nashlesky, Pearson Education, 2007.
2. “Op-Amps & Linear ICs”, Ramakanth A. Gayakwad, Pearson, 4th Edition, 2017.
3. “Modern Digital Electronics”, R. P. Jain, Tata Mcgraw Hill, 3rd Edition, 2003.
4. “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Raj Kamal, Pearson, 2nd Edition, 2012.

REFERENCE BOOKS:

1. "Basic Electronics - Devices, Circuits and IT Fundamentals", Santiram Kal, Prentice Hall of India, 2002.
2. "A Text Book of Electronic Devices and Circuits", R. S. Sedha, S.Chand & Co, 2010.
3. "Introductory Electronic Devices & Circuits - Conventional Flow Version", R. T. Paynter, Pearson Education, 2009.

Course Code	COMMUNICATIVE ENGLISH LAB		L	T	P	C
21A110201	(Common to all branches)		0	0	2	1
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with special emphasis on Listening and Speaking skills.
- To equip students with professional skills & soft skills, Develop communication skills in formal and informal situations
- To help students present themselves confidently during Group Discussions and Oral Presentations

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use creativity in listening to formal and informal conversations.

CO2: Analyze the concepts of active listening and barriers to listening.

CO3: Communicate effectively in everyday life using right oral expressions.

CO4: Acquire the confidence to present themselves effectively during academic and professional presentations.

CO5: Acquire basic knowledge of non-verbal communication and its importance.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	3	-	-	-	-	-

UNIT-I (6 Hrs)

Essentials of Listening: Purpose of Listening, Listening to Conversation (Formal and Informal), Active Listening- an Effective Listening Skill, Barriers to Listening, Listening to Announcements- (railway/ bus stations/ airport /sports announcement/commentaries etc.)

Learning Outcomes: At the end of this unit, students should be able to

- Know the difference between hearing and listening. (L2)
- Understand the purpose of active listening. (L2)
- Follow the announcements through focused listening. (L2)

UNIT-II (6 Hrs)

Listening Comprehension: Academic Listening (Listening to Lectures), Listening to Short Talks and Listening to Presentations, Note Taking Tips

Learning Outcomes: At the end of this unit, students should be able to

- Comprehend different academic lectures. (L3)
- Take notes while listening to short talks and lectures. (L3)
- Improve comprehension skills through listening to short talks and presentations. (L3)

UNIT-III (6 Hrs)

Communicating in everyday life: Asking for and giving information, Offering and responding to offers, Requesting and responding to requests, Congratulating people on their success, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving,

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate expressions to communicate in everyday life. (L3)
- Communicate effectively in different contexts of conversations. (L3)
- Participate in role plays and situational dialogues with an exposure to social and professional contexts. (L3)

UNIT- IV (6 Hrs)

Presentation Skills: Giving Short Talks, Preparing power point presentation, Greeting and Introducing in presentations, Presenting a paper, Participating in group discussions (dos & don'ts)

Learning Outcomes: At the end of this unit, students should be able to

- Prepare a power point presentation effectively. (L3)
- Present a paper in a seminar. (L3)
- Participate in Group Discussions efficiently. (L3)

UNIT-V (6 Hrs)

Non-verbal Communication: Personal Appearance, Gestures, Postures, Facial Expression, Eye Contact, Body Language (Kinesics), Silence, Tips for Improving Non-Verbal Communication

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of body language in communication (L2)
- Improve non-verbal communication skills (L3)
- Understand how body language and non-verbal communication affects the personality of an individual in a social and professional set-up. (L2)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://learnenglish.britishcouncil.org/skills/listening
2. https://agendaweb.org/listening/comprehension-exercises.html
3. https://www.123listening.com/
4. https://www.linguahouse.com/learning-english/skill-4-learners/listening
5. https://www.talkenglish.com/listening/listen.aspx
6. https://ed.ted.co

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A020304			0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To Verify Kirchoff's laws and Superposition theorem
- To learn performance characteristics of DC Machines and 1- Phase Transformer
- To Study the I – V Characteristics of Solar PV Cell
- To analyze the characteristics of Diodes, BJT, MOSFET, UJT
- To design the amplifier circuits from the given specifications.
- Exposed to linear and digital integrated circuits

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Understand Kirchoff's Laws & Superposition theorem.

CO2: Analyze the various characteristics on 1-phase transformer and DC Machines by conducting various tests.

CO3: Analyze I – V Characteristics of PV Cell

CO4: Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.

CO5: Construct and analyze the various diode rectifiers, clippers and clampers and other circuits.

CO-PO MAPPING;

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

PART A: ELECTRICAL ENGINEERING

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Load test on 1-Phase Transformer.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

PART B: ELECTRONICS ENGINEERING

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Full Wave Rectifier with & without filter.
4. Wave Shaping Circuits. (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration.
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting amplifiers using Op-AMPs.
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
9. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs all the required active devices

Note: Minimum of Six Experiments to be performed in each section.

Course Code	ADVANCED DATA STRUCTURES THROUGH C++ LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050305			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	II			

COURSE OBJECTIVES:

- To familiarize Advanced data structures using C++.
- To train the students on the sorting techniques
- To introduce Trees.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C++ using Trees.
CO3: Modularize the problem and also solution.
CO4: Design applications in C++ using Searching Techniques
CO5: Explore various operations on Linked Lists

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

1. Write a C++ program to sort the given data elements using bubble sort technique.
2. Write a C++ program to sort the given data elements using selection sort technique.
3. Write a C++ program to search a given element from the list of elements using linear search technique.
4. Write a C++ program to search a given element from the list of elements using binary search technique.
5. Write a C++ program to implement Stack ADT using an array.
6. Write a C++ program to implement Linear Queue ADT using an array.
7. Write a C++ program to implement Circular Queue ADT using an array.
8. Write a C++ program to implement Deque ADT using an array.
9. Write a C++ program to create a Single linked list ADT and display the elements.
10. Write a C++ program to create a Double linked list ADT and display the elements.
11. Write a C++ program to create a Circular single linked list and display the elements.
12. Write a C++ program to create a Circular double linked list and display the elements.
13. Write a C++ program to implement Stack ADT using linked list.
14. Write a C++ program to implement Linear Queue ADT using linked list.

15. Write a C++ program to create a binary search tree with the given data elements 23, 54, 12, 43, 56, 10, 52, 35 and apply In-order, Preorder and Post-order tree traversal techniques.

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2nd edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2nd edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3rd Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W. Savitch, Pearson education, Fourth edition

Course Code	ENVIRONMENTAL SCIENCE		L	T	P	C
21A000001	(Common to CE, ME, EEE, ECE, CSE, CSE-IOT)		**2**	**0**	**0**	**0**
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo- chemical cycles and ecological pyramids.

CO3: Understand various causes of pollution and solid waste management and related preventive measures.

CO4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5: Cases of population explosion, value education and welfare programmes.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO2	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO3	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO5	-	-	-	-	-	1	2	1	-	-	-	1	-	-

UNIT – I (10 Hrs)

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance, Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over–exploitation, deforestation, case studies - Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of public awareness (L1)
- Know about the various resources (L1)

<u>UNIT–II</u> (10 Hrs)

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes: At the end of this unit, students should be able to

- Know about various echo systems and their characteristics (L1)
- Know about the biodiversity and its conservation (L1)

<u>UNIT – III</u> (10 Hrs)

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the various sources of pollution. (L1)
- Know about the various sources of solid waste and preventive measures. (L1)

- Know about the different types of disasters and their managerial measures. (L1)

<u>UNIT- IV</u> (10 Hrs)

Social Issues and The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, water shed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the social issues related to environment and their protection acts. (L1)
- Know about the various sources of conservation of natural resources. (L1)
- Know about the wild life protection and forest conservation acts. (L1)

<u>UNIT – V</u> (10 Hrs)

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the population explosion and family welfare programmes. (L1)
- Identify the natural assets and related case studies. (L1)

<u>TEXTBOOKS:</u>

1. "Text book of Environmental Studies for Undergraduate Courses", Erach Bharucha for University Grants Commission, Universities Press.
2. "Environmental Studies", Palani swamy, Pearson education
3. "Environmental Studies", S. Azeem Unnisa, Academic Publishing Company
4. "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", K. Raghavan Nambiar, SCITECH Publications (India), Pvt. Ltd.

<u>REFERENCE BOOKS:</u>

1. "Textbook of Environmental Science", Deeksha Dave and E. Sai Baba Reddy, Cengage

Publications.
2. "Text book of Environmental Sciences and Technology", M. Anji Reddy, BS Publication.
3. "Comprehensive Environmental studies", J. P. Sharma, Laxmi publications.
4. "Environmental Sciences and Engineering", J. Glynn Henry and Gary W. Heinke, Prentice Hall of India Private limited
5. "A Text Book of Environmental Studies", G. R. Chatwal, Himalaya Publishing House
6. "Introduction to Environmental Engineering and Science", Gilbert M. Masters and Wendell P. Ela, Prentice Hall of India Private limited.

<table>
<tr><td>Course Code</td><td rowspan="2" colspan="2">MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
(Common to CSE, CSE-AI, AIML, CSE-IOT)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A110111</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">III</td></tr>
</table>

COURSE OBJECTIVES:

- To explain about the Boolean algebra, Graph theory and Recurrence relations.
- To demonstrate the application of basic methods of discrete mathematics in Computer Science problem solving.
- To elucidate solving mathematical problems from algorithmic perspective.
- To introduce the mathematical concepts which will be useful to study advanced courses Design and Analysis of Algorithms, Theory of Computation, Cryptography and Software Engineering etc.
- To reveal how solutions of graph theory can be applied to computer science problems

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Evaluate elementary mathematical arguments and identify fallacious reasoning

CO2: Understand the properties of Compatibility, Equivalence and Partial Ordering relations, Lattices and Hassee Diagrams and the general properties of Algebraic Systems

CO3: Design solutions for problems using Permutations and Combinations

CO4: Solve the homogeneous and non-homogeneous recurrence relations

CO5: Apply the concepts of functions to identify different types of Graphs and trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Statements and Notation, **Connectives-** Negation, Conjunction, Disjunction, Conditional and Bi-conditional, Statement formulas and Truth Tables. Well-formed formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications.

Normal Forms: Disjunctive Normal Forms, Conjunctive Normal Forms, Principal Disjunctive Normal Forms (PDNF), Principal Conjunctive Normal Forms (PCNF), Ordering and Uniqueness of Normal Forms.

The Theory of Inference for the Statement Calculus: Rules of Inference, Consistency of Premises and Indirect Method of Proof. The predicate Calculus, Inference theory of the Predicate Calculus

Learning Outcomes: At the end of this unit, students should be able to

- Describe logical sentences in terms of predicates, quantifiers, and logical connectives (L1)
- Evaluate basic logic statements using truth tables and the properties of logic (L5)
- Apply rules of inference to test the consistency of premises and validity of arguments (L3)
- Verify the equivalence of two formulas and their duals (L4)
- Find the Principal Conjunctive and Principal Disjunctive Normal Forms of a statement formula. (L1)

UNIT-II (12 Hrs)

Set Theory: Basic concepts of Set Theory, Representation of Discrete structures, Relations and Ordering, Functions, Recursion.

Lattices and Boolean algebra: Lattices as Partially Ordered Sets, Boolean algebra, Boolean Functions, Representation and Minimization of Boolean Functions.

Algebraic Structures: Algebraic Systems: Examples and General Properties, Semi Groups and Monoids, Groups.

Learning Outcomes*:* At the end of this unit, students should be able to

- Describe equivalence, partial order and compatible relations (L1)
- Compute Maximal Compatibility Blocks (L3)
- Identify the properties of Lattices (L2)
- Evaluate Boolean functions and simplify expression using the properties of Boolean Algebra (L5)
- Infer Homomorphism and Isomorphism (L4)
- Describe the properties of Semi groups, Monoids and Groups (L1)

UNIT-III (10 Hrs)

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Permutations and Combinations with constrained Representations, Binomial Coefficients, The Binomial and Multinomial Theorems, The Principle of Inclusion and Exclusion

Learning Outcomes*:* At the end of this unit, students should be able to

- Explain fundamental principle of counting (L2)
- Examine the relation between permutation and combination (L4)

- Solve counting problems by applying elementary counting techniques using the product and sum rules (L3)
- Apply permutations, combinations, the pigeon-hole principle, and binomial expansion to solve counting problems (L3)

UNIT-IV (10 Hrs)

Recurrence Relations: Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, The method of Characteristic Roots, Solution of Inhomogeneous Recurrence Relations.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Find the generating functions for a sequence (L1)
- Design recurrence relations using the divide-and-conquer algorithm (L6)
- Solve linear recurrence relations using method of Characteristic Roots (L3)
- Outline the general solution of homogeneous or Inhomogeneous Recurrence Relations using substitution and method of generating functions (L2)
- Solve problems using recurrence relations and recursion to analyze complexity of Algorithms (L3)

UNIT-V (10 Hrs)

Graphs: Basic Concepts, Isomorphism and Sub graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatics Number, The Four-Color Problem

Learning Outcomes: At the end of this unit, students should be able to

- Investigate if a given graph is simple or a multigraph, directed or undirected, cyclic or acyclic (L4)
- Describe complete graph and complete bipartite graphs (L1)
- Identify Euler Graphs, Hamilton Graph and Chromatic Number of a graph (L2)
- Apply the concepts of functions to identify the Isomorphic Graphs (L3)
- Apply depth-first and breadth-first search (L3)
- Apply Prim's and Kruskal's algorithms to find a minimum spanning tree (L3)

TEXTBOOKS:

1. "Discrete Mathematics for Computer Scientists & Mathematicians", Joe L. Mott. Abraham Kandel and Theodore P. Baker, Pearson, 2008, 2nd Edition,
2. "Discrete Mathematical Structures with Applications to Computer Science", J P Trembly and R Manohar, McGraw Hill, 2017, 1st Edition.

REFERENCE BOOKS:

1. "Discrete and Combinatorial Mathematics, an Applied Introduction", Ralph P. Grimaldi and B.V. Ramana, Pearson, 2016, 5th Edition.
2. "Graph Theory with Applications to Engineering", Narsingh Deo, Prentice Hall, 1979.
3. "Discrete Mathematics theory and Applications", D.S. Malik and M.K. Sen, Cengage Learning, 2012, 1st Edition.
4. "Elements of Discrete Mathematics, A computer Oriented approach", C L Liu and D P Mohapatra, McGraw Hill, 2018, 4th edition.

Course Code	DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050401			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To understand the basic theoretical concepts of digital systems like the binary system and Boolean algebra.
- To express real life problem in logic design terminology.
- To use Boolean algebraic formulations to design digital systems. To design using combinational/sequential circuits
- To understand the Instruction execution stages.
- To explain the functions of the various computer hardware components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Identify the basic functional units and different ways of interconnecting to form a computer system.

CO2: Design; understand the number systems, combinational sequential circuits.

CO3: Inspect the Computer Arithmetic operations performed on fixed point and floating point numbers.

CO4: Apply effective memory management strategies

CO5: Describe various techniques for I/O data transfer methods and interrupt handling mechanisms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	-	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	1		-	-	-	-	-	-	-	-	-

UNIT- I (12 Hrs)

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations.

Data Representation: Binary Numbers, Fixed Point Representation. Floating – Point Representation. Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Identify the basic functional units and different ways of interconnecting to form a computer system. (L2)
- Summarize the binary number system (L2)
- Illustrate various binary codes (L3)

<u>UNIT- II</u> (12 Hrs)

Digital Logic Circuits - I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. Flip-flops, Combinational Circuits.

Digital Logic Circuits - II: Registers, Shift Registers, Binary counters, Decoders, Multiplexers, Programmable Logic Devices.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Develop a logic diagram using gates from a Boolean function (L3)
- Apply the map method for simplifying Boolean Expressions. (L2)
- Analyze and design combinational circuits. (L3)
- Explain the functionalities of latch and different flip-flops (L2)

<u>UNIT- III</u> (12 Hrs)

Computer Arithmetic: Algorithms for fixed point and floating-point addition, subtraction, multiplication and division operations, Hardware Implementation of arithmetic and logic operations, High performance arithmetic.

Instruction Set & Addressing: Memory Locations and Addresses, Machine addresses and sequencing, Various Addressing Modes, Instruction Formats, Basic Machine Instructions, IA-32 Pentium example.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Illustrate various addressing modes for accessing register and memory operands. (L3)
- Describe the instruction sequencing and various types of instructions. (L2)
- Describe the operations performed on floating point numbers. (L2)

<u>UNIT- IV</u> (11 Hrs)

Processor Organization: Introduction to CPU, Register Transfers, Execution of Instructions, Multiple Bus Organization, Hardwired Control, Microprogrammed Control.

Memory Organization: Concept of Memory, RAM, ROM memories, memory hierarchy, cache memories, virtual memory, secondary storage, memory management requirements.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Distinguish between hardwired and micro programmed control units. (L3)
- Recognize the various types of memories. (L2)
- Analyze the performance of cache memory. (L3)
- Apply effective memory management strategies (L2)

UNIT- V (11 Hrs)

Input / Output Organization: Introduction to I/O, Interrupts- Hardware, Enabling and disabling Interrupts, Device Control, Direct memory access, buses, interface circuits, standard I/O Interfaces.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the basics of I/O data transfer synchronization. (L3)
- Analyze the interrupt handling mechanisms of various processors. (L3)
- Describe various techniques for I/O data transfer methods. (L2)

TEXTBOOKS:

1. "Computer Organization", Carl Hamacher, ZvonkoVranesic, SafwatZaky, McGraw Hill, 5th edition.
2. "Computer Architecture and Organization- An Integrated Approach", Miles Murdocca, Vincent Heuring, Wiley India, Second Edition.
3. "Computer Systems Architecture", M. Morris Mano, Pearson, 3rd Edition.

REFERENCE BOOKS:

1. "Computer Organization and Architecture", William Stallings, Pearson, Sixth Edition,
2. "Computer - organization and Design", David A. Paterson and John L. Hennessy, Elsevier.
3. "Fundamentals or Computer Organization and Design", Sivarama Dandamudi, Springer Int. Edition.
4. "Digital Design", M. Morris Mano, Pearson Education/PHI, Third Edition
5. "Fundamentals of Logic Design", Roth, Thomson, 5th Edition.

Course Code	DATABASE MANAGEMENT SYSTEM		L	T	P	C
21A050402	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Train in the fundamental concepts of database management systems, database modelling and design, SQL, PL/SQL and system implementation techniques.
- Enable students to model ER diagram for any customized application
- Inducting appropriate strategies for optimization of queries.
- Provide knowledge on concurrency techniques
- Demonstrate the organization of Databases

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		-	-	-	-	-	-	-	2	1	-
CO2	3	2	3	3	-	-	-	-	-	-	3	3	1	-
CO3	-	2	3	3	-	-	-	-	-	-	2	-	1	-
CO4	-	2	-	3	2	-	-	-	-	-	-	-	-	2
CO5	-	-	-	3	3	-	-	-	-	-	-	3	-	2

UNIT-I (12 Hrs)

Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators.

Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between Database and File System (L3)
- Categorize different kinds of data models (L4)
- Define functional components of DBMS (L1)

UNIT-II (12 Hrs)

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL**:** Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization.

Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.

Learning Outcomes**:** At the end of this unit, students should be able to

- Outline the elements of the relational model such as domain, attribute, tuple, relation, and entity (L4)
- Distinguish between various kinds of constraints like domain, key, and integrity (L4)
- Define relational schema (L1)
- Develop queries using Relational Algebra and SQL (L6)
- Perform DML operations on databases (L3)

UNIT-III (12 Hrs)

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues.

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms

Learning Outcomes**:** At the end of this unit, students should be able to

- Develop E-R model for the given problem (L6)
- Derive tables from E-R diagrams (L6)
- Differentiate between various normal forms based on functional dependency (L4)
- Apply normalization techniques to eliminate redundancy (L3)

UNIT-IV (11 Hrs)

Query Processing: Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions.

Query optimization: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.

Learning Outcomes**:** At the end of this unit, students should be able to

- Identify variety of methods for effective processing of given queries. (L2)
- Obtain knowledge related to optimization techniques. (L6)

UNIT-V (12 Hrs)

Transaction Management: Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.

Concurrency Control: Lock based Protocols, Deadlock Handling, Multiple granularities, Timestamp based Protocols, Validation based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Non-volatile Storage, Early Lock Release and Logical Undo Operations.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand various properties of transaction. (L2)
- Design atomic transactions for an application. (L6)
- Gain the knowledge about log mechanism and check pointing techniques for system recovery. (L6)

TEXTBOOKS:

1. "Database System Concepts" A. Silberschatz, H. F. Korth, S. Sudarshan, TMH, 2019, 6/e.

REFERENCE BOOKS:

1. "Database Management System", Shamkant B. Navathe, Ramez Elmasri, PEA, 6/e.
2. "Database Principles Fundamentals of Design Implementation and Management", Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
3. "Database Management Systems", Raghurama Krishnan, Johannes Gehrke, TMH, 3/e.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA (Common to CSE, CSE-AI, AIML CSE-IOT)		L	T	P	C
21A050403			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

COURSE OUTCOMES:

Students will be able to:

CO1: To solve real world problems using OOP techniques.
CO2: To apply code reusability through inheritance, packages, and interfaces
CO3: To develop applications by using parallel streams for better performance.
CO4: To solve problems using java collection framework and I/O classes.
CO5: To develop applets for web applications, to build GUIs and handle events generated by user interactions, to use the JDBC API to access database

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	3	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	3	-	-	-	-	-	3	3	-	2

UNIT–I (12 Hrs)

Introduction: Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the syntax, semantics, and features of Java Programming Language. (L2)
- Learn object-oriented features and understanding type conversion and casting. (L2)
- Understand different types of string handling functions and its usage. (L2)

UNIT–II (10 Hrs)

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, finding packages and CLASSPATH, Access Protection, Importing packages.

Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

Learning Outcomes: At the end of this unit, students should be able to

- Implement types of Inheritance and developing new classes based on existing classes(L3)
- Distinguish between system packages and user defined packages. (L4)
- Demonstrate features of interfaces to implement multiple inheritances. (L3)

UNIT – III (12 Hrs)

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes.

Stream based I/O (java.io) – The Stream Classes-Byte streams and Character streams, reading console Input and Writing Console Output, File class, Reading and
writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

Learning Outcomes: At the end of this unit, students should be able to

- Learn what exceptions are and how they are handled. (L2)
- Learn when to use exception handling and how to create user defined exceptions (L6)
- Learn the difference between various files and streams. (L4)

UNIT – IV (12 hrs)

Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hash table, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

Learning Outcomes: At the end of this unit, students should be able to

- Understand concurrency, parallelism, and multithreading (L2)
- Learn the importance of collections and use prebuilt generic data structures from framework. (L3)

UNIT-V (12 hrs)

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirm dialog, show input dialog, show option dialog, jdialog, create a modeles sdialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Learning Outcomes: At the end of this unit, students should be able to

- Learn how to use the Nimbuslook-and-feel (L3)
- Understand the GUI programming. (L2)
- Understand basic steps in developing JDBC applications (L2)

TEXTBOOKS:

1. "Java The complete reference", Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd, 9th edition.
2. "Java How to Program", Paul Dietel, Harvey Dietel, Pearson Education,10th Edition.

REFERENCE BOOKS:

1. "Understanding Object-Oriented Programming with Java", T. Budd, Pearson Education, updated edition.
2. "Core Java Volume – 1 Fundamentals", Cay S. Horstmann, Pearson Education.
3. "Java Programming for core and advanced learners", Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press
4. "Introduction to Java programming", Y. Daniel Liang, Pearson Education.
5. Object Oriented Programming through Java", P. Radha Krishna, "University Press.
6. "Programming in Java", S. Malhotra, S. Choudhary, Oxford Univ. Press, 2nd edition.
7. "Java Programming and Object-oriented Application Development", R.A. Johnson, Cengage Learning.

Course Code	MICROPROCESSORS AND MICROCONTROLLERS (Common to CSE, CSE-IOT)		L	T	P	C
21A050309			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers
- To impart knowledge on addressing modes, instruction set and assembly language programming of 8086 and 8051
- To demonstrate memory and I/O interfacing with 8086
- To describe the architecture and features of Intel 8051 microcontroller
- To explain the interfacing of external I/O devices with 8051 microcontrollers

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the concepts of 8086 microprocessors

CO2: Explain addressing modes of 8086 and develop assembly language programs for various problems

CO3: Describe the interfacing of 8086 with memory and peripheral devices

CO4: Distinguish between microprocessor and microcontroller and explain the concepts of 8051 microcontrollers

CO5: Explain the interfacing of external devices with 8051 microcontrollers and develop assembly language programs for various problems

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	3	1	-
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	3	-	2

UNIT-I (12 Hrs)

Introduction to 8086 Microprocessor: 8086 Architecture, Block Diagram, Register Organization, Flag Register, Pin Diagram, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize features of 8086 microprocessor (L2)
- Describe about interrupt structure of 8086 and Interrupt Vector Table (L2)
- Explain the memory segmentation (L2)

UNIT-II (12 Hrs)
8086 Microprocessor Instruction Set and Addressing Modes, Instruction Set of 8086, Assembly Language Programming, Simple programs, Assembler Directives, Procedures and Macros, String manipulation instructions, Simple ALPs.
Learning Outcomes: At the end of this unit, students should be able to

- Understand instruction set of 8086 microprocessor (L1)
- Explain addressing modes of 8086 (L2)
- Develop assembly language programs for various problems (L2)

UNIT-III (12 Hrs)
8086 Interfacing: Programmable Peripheral Interface 8255, Programmable Interval Timer 8253, Programmable Interrupt Controller 8259, Programmable Communication Interface 8251 USART, DMA Controller 8257.
Case Study:

1. 8255 – PPI and its interfacing program– Stepper motor interfacing
2. Interfacing of 7-Segment Display with 8086 microprocessor using 8255.

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate memory & I/O interfacing with 8086 (L2)
- Describe interfacing of 8086 with peripheral devices (L2)

UNIT-IV (10 Hrs)
Intel 8051 Microcontroller, Microprocessor vs Microcontroller, 8051 Microcontroller Architecture, 8051 pin diagram, 8051 Ports, Alternate functions of I/O pins, Memory organization, Internal RAM structure, Stack operation, Counters and Timers, Serial Communication in 8051, interrupts in 8051.
Learning Outcomes: At the end of this unit, students should be able to

- Describe architecture and features of Intel 8051 microcontroller (L2)
- Develop assembly language programs to perform various operations using 8051 (L2)
- Distinguish between microprocessor and a microcontroller (L5)

UNIT-V (12 Hrs)
8051 Instruction Set and Programming: Introduction, Addressing modes of 8051, Instruction set of 8051, Data Transfer Instructions, Data and Bit-Manipulation Instructions, Arithmetic Instructions, simple programs, Interfacing Examples: External memory interfacing in 8051, interfacing of push button switches and LEDS, Interfacing of Relay, Interfacing of seven segment displays, Interfacing of Key board.
Case Study:

1. Interfacing of Seven segment display with 8051 microcontroller
2. Switch interfacing with 8051 microcontroller

3. Relay interfacing with 8051 microcontroller

Learning Outcomes: At the end of this unit, students should be able to

- Understand instruction set of 8051 microcontroller (L1)
- Explain addressing modes of 8051 (L2)
- Develop assembly language programs for various problems (L2)
- Explain the interfacing of 8051 with external devices (L2)

TEXTBOOKS:

1. "Advanced Microprocessors and Peripherals", K M Bhurchandi, A K Ray, McGraw Hill Education, 2017, 3rd edition.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2012, 2nd edition.

REFERENCE BOOKS:

1. "Microprocessor and Interfacing: Programming and Hardware", Douglas V. Hall, McGraw Hill
2. "The 8051 Microcontroller", Kenneth J. Ayala, Cengage Learning, 3rd edition, 2004.
3. "Microprocessors and Interfacing 8086, 8051, 8096 and advanced processors", Senthil Kumar, Saravanan, Jeevanathan, Shah, Oxford University Press, 1st edition, 2012.

Course Code	DATABASE MANAGEMENT SYSTEMS LAB		L	T	P	C
21A050404	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To implement the basic knowledge of SQL queries and relational algebra.
- To construct database models for different database applications.
- To apply normalization techniques for refining of databases.
- To practice various triggers, procedures, and cursors using PL/SQL.
- To design and implementation of a database for an organization

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

I. CREATION OF DATA BASE TABLES

1. Create a table called Employee with fields (Empno, Ename, Job, Mgr, Sal)
   a. Add a column commission with domain to the Employee table.
   b. Insert any five records into the table.
   c. Update the column details of job
   d. Rename the column of Employ table using alter command.
   e. Delete the employee whose empno is 19

2. Create department table with fields (Deptno, Deptname, Location).
   a. Add column designation to the department table.
   b. Insert values into the table.
   c. List the records of emp table grouped by dept no.

d. Update the record where dept no is 9.
e. Delete any column data from the table.

II: EXECUTING QUERIES USING DDL AND DML COMMANDS

1. a. Create a user and grant all permissions to the user on employee table.
   b. Insert the any three records in the employee table and use rollback. Check the result.
   c. Add primary key constraint and not null constraint to the employee table.
   d. Insert null values to the employee table and verify the result.
   e. By using the group by clause, display the names who belongs to dept no 10 along with average salary.
   f. Display lowest paid employee details under each department.
   g. Display number of employees working in each department and their department number
2. a. Create a user and grant all permissions to the user on department table
   b. Insert values in the department table and use commit.
   c. Add constraints like unique and not null to the department table.
   d. Insert repeated values and null values into the table.
   e. Calculate the average salary for each different job.
   f. Show the average salary of each job excluding manager.
   g. Show the average salary for all departments employing more than three people.
   h. Display employees who earn more than the lowest salary in department30

III. CASE STUDIES:

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records
10. Supply chain management system

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

REFERENCE BOOKS:

1. "Database Systems", Ramez Elmasri, Shamkant, B. Navathe, Pearson Education, 6th Edition, 2013.
2. "Database System Concepts" Peter Rob, Carles Coronel, Cengage Learning, 7th Edition, 2008.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB (Common to CSE, CSE-AI & CSE-IOT)		L	T	P	C
21A050405			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To introduce the concepts of Java.
- To Practice object-oriented programs and build java applications.
- To implement java programs for establishing interfaces.
- To implement sample programs for developing reusable software components.
- To establish database connectivity in java and implement GUI applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Recognize the Java programming environment.
CO2: Develop efficient programs using multithreading.
CO3: Design reliable programs using Java exception handling features.
CO4: Extend the programming functionality supported by Java.
CO5: Select appropriate programming construct to solve a problem.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF APPLICATIONS

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records

10. Supply chain management system

For Every Application:

The following Tasks need to be done:

1. Write a java program to create classes and declare variables?
2. Write a java program to create a constructor?
3. Write a java program to perform exception handling to catch runtime exceptions?
4. Write a java program to implement inheritance for increasing reusability of code?
5. Write a java program to create interfaces for achieving data abstraction?
6. Write a java program to create files for input and output data storage?
7. Write a java program for implementing collection framework for effective management of data objects?
8. Write a java program for creating Graphical User Interface using swings?
9. Write a java program for implementing jdbc connectivity for application connecting with database?

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

Course Code	GAME PROGRAMMING LAB		L	T	P	C
21A050308			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- Understand the concepts of Game design and development.
- Learn the processes, mechanics and issues in Game Design.
- Be exposed to the Core architectures of Game Programming.
- Know about Game programming platforms, frame works and engines.
- Learn to develop games.

COURSE OUTCOMES:

After completing the course student will be able to:

CO1: Identify the analysis tools as they apply to 3D
CO2: Understands the problems solved in current GP systems
CO3: Describes the advantages of current GP systems
CO4: Understand the difficulty of representing and designing games.
CO5: Understand the latest technologies for linking, describing and searching the web.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS

Week 1 – Week 4:

MODULE-I: 3D GRAPHICS FOR GAME PROGRAMMING

3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics-based Simulation, Scene Graphs.

Week 5 – Week 8:

MODULE - II: GAME ENGINE DESIGN

Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.

Week 9 – Week 12:

MODULE - III: GAME PROGRAMMING

Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.

TEXTBOOKS:

1. "Game Coding Complete", Mike Mc Shaffrfy and David Graham, Cengage Learning, Fourth Edition, 2012.
2. "Game Engine Architecture", Jason Gregory, CRC Press, 2009.
3. "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics", David H. Eberly, Morgan Kaufmann Publications, 2nd Edition, 2006.

REFERENCE BOOKS:

1. "Fundamentals of Game Design", Ernest Adams and Andrew Rollings, Prentice Hall / New Riders, 2nd Edition, 2009.
2. "Mathematics for 3D Game Programming and Computer Graphics", Eric Lengyel, Course Technology PTR, 3rd Edition, 2011.
3. "The Art of Game Design: A book of lenses", Jesse Schell, CRC Press, 1st Edition, 2008.

Course Code	GRAPHICS DESIGN USING PHOTOSHOP		L	T	P	C
21A050702	(Common to CSE, CSE-IOT)		1	0	2	2
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Acquaint with graphic design techniques, principles of page layout and design, and photo editing.
- Various software, including Adobe Photoshop
- Adobe Illustrator.

COURSE OUTCOMES:

After completing the course student will be able to:

CO1: Identify the analysis tools
CO2: Describes the use of graphics in Animation
CO3: Understand the difficulty of representing and designing games.
CO4: Understand the latest technologies for linking, describing and searching the web.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Week 1 – Week 2: Photoshop Basics
Week 3 – Week 4: Intro to Design Elements
Week 5 – Week 6: Font Portfolio
Week 7 – Week 8: Logos and Ads
Week 9 – Week 10: Photoshop Movie Posters
Week 11 – Week 12: Adobe Illustrator

Course Code	CONSTITUTION OF INDIA		L	T	P	C
21A000002	(Common to all branches)		**2**	**0**	**0**	**0**
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand historical background of the constitution making and its importance for building a democratic India.

CO2: Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India.

CO4: Analyze the decentralization of power between central, state and local self-government

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO2	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO3	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO4	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO5	-	-	-	-	-	3	-	2	1	-	-	1	-	-

UNIT-I (10 Hrs)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution-Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Indian constitution (L1)
- Apply the knowledge on directive principle of state policy (L3)
- Analyze the History and features of Indian constitution (L4)
- Learn about Preamble, Fundamental Rights and Duties (L1)

UNIT-II (10 Hrs)

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of Indian government (L1)
- Differentiate between the state and central government (L4)
- Explain the role of President and Prime Minister (L2)
- Know the Structure of supreme court and High court (L1)

UNIT-III (10 Hrs)

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of state government (L1)
- Analyze the role of Governor and Chief Minister (L4)
- Explain the role of State Secretariat (L2)
- Differentiate between structure and functions of state secretariat (L4)

UNIT-IV (10 Hrs)

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning Outcomes: At the end of this unit, students should be able to

- Understand the local Administration (L1)
- Compare and contrast district administration's role and importance (L4)
- Analyze the role of Mayor and elected representatives of Municipalities (L4)
- Learn about the role of Zilla Parishath block level organization (L1)

UNIT-V (10 Hrs)

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Learning Outcomes: At the end of this unit, students should be able to

- Know the role of Election Commission (L1)

- Contrast and compare the role of Chief Election commissioner and Commissionerate (L4)
- Analyze the role of state election commission (L4)
- Evaluate various commissions viz SC/ST/OBC and women (L6)

TEXTBOOKS:

1. "Introduction to the Constitution of India", Durga Das Basu, Prentice Hall of India Pvt. Ltd. New Delhi
2. "Indian Constitution", Subash Kashyap, National Book Trust

REFERENCE BOOKS:

1. "Dynamics of Indian Government & Politics", J.A. Siwach,
2. "Constitutional Law of India", H.M.Sreevai, 4th edition in 3 volumes (Universal Law Publication)
3. "Indian Government and Politics", J.C. Johari, Hans India

Course Code	PYTHON PROGRAMMING & DATA SCIENCE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050306			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To learn the fundamentals of Python.
- To discuss the concepts of Functions and Exceptions.
- To familiarize with Python libraries for Data Analysis and Data Visualization.
- To introduce preliminary concepts in Pattern Recognition and Machine learning.
- To provide an overview of Deep Learning and Data Science models.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.

CO2: Demonstrate proficiency in handling Strings and File Systems.

CO3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.

CO4: Interpret the concepts of NumPy, MatPlotLib, & Pandas as used in Python.

CO5: Implement exemplary applications related to Machine Learning, Deep learning and Data Science Models in Python.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language,

Control Flow Statements: The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement.

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples
Learning Outcomes: At the end of this unit, students should be able to

- List the basic constructs of Python. (L1)
- Apply the conditional execution of the program (L3)
- Use the data structure lists, Dictionaries and Tuples (L3)

<u>UNIT-II</u> (10 Hrs)
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings,
Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters.
Errors and Exceptions: What Are Exceptions? Exceptions in Python, Detecting and Handling Exceptions, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions
Learning Outcomes: At the end of this unit, students should be able to

- Design programs for manipulating strings (L6)
- Solve the problems by applying the modularity principle. (L3)
- Classify exceptions and explain the ways of handling them. (L4)

<u>UNIT-III</u> (10 hrs)
Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files,
Introduction to **NumPy, Pandas, Matplotlib**.
Exploratory Data Analysis (EDA): Data Science life cycle, Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA.
Data Visualization: Scatter plot, bar chart, histogram, boxplot, heat maps, etc
Learning Outcomes: At the end of this unit, students should be able to

- Creating file handling scripts. (L6)
- Demonstrate various mathematical operations on arrays using NumPy (L2)
- Analyze and manipulate Data using Pandas (L4)
- Creating static, animated, and interactive visualizations using Matplotlib. (L6)

<u>UNIT-IV</u> (15 hrs)
Introduction to Pattern Recognition and Machine Learning: Patterns, features, pattern representation, the curse of dimensionality, dimensionality reduction.

Classification—linear and non-linear. Bayesian, Nearest neighbor classifier, Logistic regression, Naïve-Bayes, decision trees and random forests; boosting and bagging.
Clustering---partitional and hierarchical; k-means clustering. Regression.
Cost functions, Cross-validation, Confusion matrix, evaluation metrics
Learning Outcomes: At the end of this unit, students should be able to

- Define Patterns and their representation (L1)
- Describe the Classification and Clustering (L2)
- Illustrate cost functions and class imbalance (L3)

UNIT-V (10 hrs)
Introduction to Deep Learning: Perceptron, Multilayer perceptron. Back propagation. Loss functions. Hyper parameter tuning, Overview of RNN, CNN and LSTM.
Overview of Data Science Models: Applications to text, images, recommender systems, image classification, Social network graphs
Learning Outcomes: At the end of this unit, students should be able to

- Describe RNN, CNN and LSTM (L2)
- Explain the applications of Data Science (L2)

TEXTBOOKS:

1. "Think Python", Allen B. Downey, SPD/O'Reilly, 2nd edition, 2016
2. "Doing Data Science, Straight Talk from the Frontline", Cathy O'Neil, Rachel Schutt, O'Reilly, 2013.
3. "Pattern Recognition and Machine Learning", Christopher Bishop, Springer, 2007.

REFERENCE BOOKS:

1. "Introduction to Python Programming", Gowri Shankar S, Veena A, CRC Press/Taylor & Francis, 1st Edition, 2018. ISBN-13: 978-0815394372,
2. "Python Data Science Handbook: Essential Tools for Working with Data", Jake Vander Plas, O'Reilly Media, 1st Edition, 2016. ISBN-13: 978-1491912058
3. "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Aurelien Geron, O'Reilly Media, 2nd Edition, 2019. ISBN – 13: 978-9352139057
4. "Core Python Applications Programming", Wesley J Chun, Pearson Education India, 3rd Edition, 2015. ISBN-13: 978-9332555365.
5. "Flask Web Development: Developing Web Applications with Python", Miguel Grinberg, O'Reilly Media, 2nd Edition, 2018. ISBN-13: 978-1491991732.

Course Code	SOFTWARE ENGINEERING & OOAD		L	T	P	C
21A050407	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- The students will have a broad understanding of the discipline of software engineering and its application to the development of and management of software systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Knowledge of basic SW engineering methods and practices, and their appropriate application; general understanding of software process models such as the waterfall and evolutionary models. understanding of the role of project management including planning, scheduling, risk management, etc.

CO2: Understanding of software requirements and the SRS document. Understanding of different software architectural styles.

CO3: Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

CO4: Understanding of software testing approaches such as unit testing and integration testing. Understanding of software evolution and related issues such as version management. Understanding on quality control and how to ensure good quality software.

CO5: Understanding of some ethical and professional issues that are important for software engineers. Development of significant teamwork and project-based experience

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO5	2	3	2	1		-	-	-	-	-	-	-	-	2

UNIT- I (12 Hrs)

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize the basic issues in commercial software development. (L3)
- Summarize software lifecycle models. (L5)
- Infer Workout project cost estimates using COCOMO and schedules using PERT and GANTT charts (L3)

UNIT- II (12 Hrs)

Requirements Engineering: Software Requirements, Requirements engineering Process, Requirement's elicitation, Requirements Analysis, Structured Analysis, Data Oriented Analysis, Object oriented Analysis, Prototyping Analysis, Requirements Specification, Requirements Validation, requirement Management.

Learning Outcomes: At the end of this unit, students should be able to

- Identify basic issues in software requirements analysis and specification. (L3)
- Develop SRS document for sample problems using IEEE 830 format. (L5)
- Develop algebraic and axiomatic specifications for simple problems. (L6)

UNIT- III (12 Hrs)

Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Design Methodologies, Structured Design, Object-Oriented Design: Object oriented Analysis and Design Principles. UML Diagrams, Basic Behavioural Modelling: Interactions, Interaction diagrams. Case Study: The Unified Library application.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in software design. (L3)
- Apply the structured, object-oriented analysis and design (SA/SD) technique. (L5)
- Recognize the basic issues in user interface design. (L4)

UNIT- IV (12 Hrs)

Implementation: Coding Principles, Coding Process, Code verification, Code documentation Software Testing: Testing Fundamentals, Test Planning, Black Box Testing, White Box Testing, Levels of Testing, Usability Testing, Regression testing, Debugging approaches.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in coding practice. (L3)
- Recognize the basic issues in software testing. (L5)
- Design test cases for black box and white box testing. (L6)

UNIT- V (11 Hrs)

Software Project Management: Project Management Essentials, What is Project management, Software Configuration Management. Project Planning and Estimation: Project Planning activities, Software Metrics and measurements, Project Size Estimation, Effort Estimation Techniques

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in Software Project Management. (L3)
- Learn and practice project planning activities. (L5)
- Design and develop software metrics and Estimations. (L6)

TEXTBOOKS:

1. "Fundamentals of Software Engineering", Rajib Mall, PHI, 5^{th} Edition, 2018.
2. "Software Engineering- Practioner Approach", Pressman R, McGraw Hill.
3. "Fundamentals of Object-Oriented Design in UML", Meilir Page-Jones, Pearson Education.

REFERENCE BOOKS:

1. "Software Engineering", Somerville, Pearson
2. "Software Engineering Concepts", Richard Fairley, Tata McGraw Hill.
3. "An integrated approach to Software Engineering", Jalote Pankaj, Narosa

Course Code	**COMPUTER NETWORKS**		**L**	**T**	**P**	**C**
21A050408	(Common to CSE, CSE-AI, AIML, CSE-IOT)		**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Familiarize with the applications of Internet
- Explore the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Elucidate the design issues for a computer network

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the software and hardware components of a Computer network (L3)
CO2: Develop new routing, and congestion control algorithms (L3)
CO3: Assess critically the existing routing protocols (L5)
CO4: Explain the functionality of each layer of a computer network (L2)
CO5: Choose the appropriate transport protocol based on the application requirements (L3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT–I (8 Hrs)

Computer Networks and the Internet: What is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models, Networks under attack, History of Computer Networking and the Internet

Learning Outcomes: At the end of this unit, students should be able to

- Enumerate the hardware components of a computer network (L1)
- List the layers of a Computer Network (L1)
- Identify the performance metrics of a computer network (L3)

UNIT–II (12 Hrs)

Application Layer Principles of Network Applications, The web and HTTP, File transfer: FTP, Electronic mail in the internet, DNS-The Internet's Directory Service, Peer-to-Peer Applications

Learning Outcomes: At the end of this unit, students should be able to

- Design new applications of a computer network (L6)
- Analyze the application protocols (L4)
- Extend the existing applications (L2)

UNIT–III (14 Hrs)

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, Connectionless Transport: UDP, Principles of Reliable Data transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control

Learning Outcomes: At the end of this unit, students should be able to

- Design Congestion control algorithms (L6)
- Select the appropriate transport protocol for an application (L3)
- Identify the transport layer services (L2)

UNIT–IV (12 Hrs)

The Network Layer: Introduction, Virtual Circuit and Datagram Networks, The Internet Protocol (IP): Forwarding and Addressing in the Internet, Routing Algorithms, Routing in the Internet, Broadcast and Multicast Routing

Learning Outcomes: At the end of this unit, students should be able to

- Compare routing algorithms (L4)
- Design routing algorithms (L6)
- Extend the existing routing protocols (L2)

UNIT–V (12 Hrs)

The Layer: Links, Access Networks, and LANs Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request

Learning Outcomes: At the end of this unit, students should be able to

- Compare medium access protocols (L4)
- Classify the computer networks (L2)
- Design a Data Centre for an organization (L6)

TEXTBOOKS:

1. "Computer Networking: A Top-Down Approach", James F. Kurose, Keith W. Ross, Pearson, 6th edition, 2019.

REFERENCE BOOKS:

1. "Data communications and Networking", Forouzan, McGraw Hill Publication, 5th Edition.
2. "Computer Networks", Andrew S. Tanenbaum", David J. Wetherall, Pearson, 5th Edition.
3. "Networks for Computer Scientists and Engineers", Youlu Zheng, Shakil Akthar, Oxford Publishers, 2016.

Course Code	OPERATING SYSTEMS	L	T	P	C
21A050409	(Common to CSE, CSE-AI, AIML, CSE-IOT)	3	0	0	3
Pre-requisite	NIL	Semester	IV		

COURSE OBJECTIVES:

- Understand basic concepts and functions of operating systems
- Understand the processes, threads and scheduling algorithms.
- Provide good insight on various memory management techniques
- Expose the students with different techniques of handling deadlocks
- Explore the concept of file-system and its implementation issues
- Familiarize with the basics of Linux operating system
- Implement various schemes for achieving system protection and security

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Realize how applications interact with the operating system. Analyze the functioning of a kernel in an Operating system. **(K3)**

CO2: Summarize resource management in operating systems. Analyze various scheduling algorithms **(K2)**

CO3: Examine concurrency mechanism in Operating Systems. Apply memory management techniques in design of operating systems **(K4)**

CO4: Understand the functionality of file system. Compare and contrast memory management techniques. **(K2)**

CO5: Understand the deadlock prevention and avoidance. Perform administrative tasks on Linux based systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT-I (8 Hrs)

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

Learning Outcomes: At the end of this unit, students should be able to

- Identify major components of operating systems (L2)
- Understand the types of computing environments (L2)
- Explore several open-source operating systems (L3)
- Recognize operating system services to users, processes and other systems (L3)

UNIT-II (12 Hrs)

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples.

Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers' problem, Readers and writers problem.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance, features of a process and methods of communication between processes. (L2)
- Improving CPU utilization through multi programming and multithreaded programming (L3)
- Examine several classical synchronization problems (L3)

UNIT-III (12 Hrs)

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the various techniques of allocating memory to processes (L3)
- Summarize how paging works in contemporary computer systems (L3)
- Understanding the benefits of virtual memory systems. (L2)

UNIT-IV (14 Hrs)

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Investigate methods for preventing/avoiding deadlocks (L3)
- Examine file systems and its interface in various operating systems (L2)
- Analyze different disk scheduling algorithms (L3)

UNIT-V (14 Hrs)

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Infer various schemes available for achieving system protection. (L2)
- Acquiring knowledge about various countermeasures to security attacks (L3)
- Outline protection and security in Linux and Microsoft Windows. (L2)

TEXTBOOKS:

1. "Operating System Concepts", Silberschatz A, Galvin P B, and Gagne G, Wiley, 9th edition, 2016.
2. "Modern Operating Systems", Tanenbaum A S, Pearson Education, 3rd edition, 2008.

REFERENCE BOOKS:

1. "Operating Systems Design and Implementation", Tanenbaum A S, Woodhull A S, PHI, 3rd edition, 2006.
2. "Operating Systems A Concept Based Approach", Dhamdhere D MTata McGraw-Hill, 3rd edition, 2012.
3. "Operating Systems -Internals and Design Principles", Stallings W, Pearson Education, 6th edition, 2009
4. "Operating Systems", Nutt G, Pearson Education, 3rd edition, 2004

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all branches)		L	T	P	C
21A110203			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To know the various types of Market Structures & pricing methods and its strategies.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Analyse the consumer behaviour with regard to their product or services and measure demand of a particular product or services by applying various methods in given situation

CO2: Determine Break Even Point (BEP) of an enterprise Assess the cost behaviour, costs useful for managerial decision making

CO3: Determine the price of a product or services in given market condition

CO4: Analyze the financial position by using different types of ratios and interpret the financial accounting

CO5: Evaluate the investment proposals under payback period, ARR, IRR, NPV & PI methods

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT- I (11 Hrs)

Introduction to Managerial Economics and Demand Analysis: Managerial Economics– Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand- Demand Forecasting- Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Learning Outcomes: At the end of this unit, students should be able to

- Know the nature and scope of Managerial Economics and its importance. (L1)
- Understand the concept of demand and its determinants. (L2)
- Analyse the elasticity and degree of elasticity. (L4)
- Evaluate demand forecasting methods. (L5)
- Design the process of demand estimation for different types of demand. (L6)

UNIT- II (10 Hrs)

Theory of Production and Cost Analysis:

Production Function – Short-run and Long-run Production Function -Isoquants and Iso costs, MRTS –Least cost combination of Inputs, Cobb-Douglas Production Function - Laws of Returns – Internal and External Economies of scale – **Cost & Break-Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA)–Determination of Break-Even Point (Simple Problems)-Managerial significance of Break-Even Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, Input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)
- Develop Profit appropriation for different levels of business activity. (L6)

UNIT- III (11 Hrs)

Introduction to Markets and New Economic Environment:

Market structures Types of Markets-Perfect and Imperfect Competition- Features of Perfect Competition– Monopoly -Monopolistic Competition –Oligopoly-Price-Output Determination-Pricing Methods and Strategies- Forms of Business Organizations - Sole Proprietorship - Partnership – Joint Stock Companies-Public Sector Enterprises -.New economic Environment - **Economic Liberalization – Privatization – Globalization.**

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)

UNIT- IV (10 Hrs)

Capital and Capital Budgeting: Concept of Capital-Significance-Types of Capital-Components of Working Capital - Sources of Short-term and Long-term Capital -Estimating Working capital requirements-**Capital Budgeting**–Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate

of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept of Capital Budgeting and its importance in business (L1)
- Contrast and compare different investment appraisal methods. (L4)
- Analyse the process of selection of investment alternative using different appraisal methods. (L4)
- Evaluate methods of Capital budgeting techniques. (L5)
- Design different investment appraisals and make wise investments. (L6)

UNIT–V (10 Hours)

Introduction to Financial Accounting and Analysis: Financial Accounting – Concept – Emerging need and Importance - Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet (with simple adjustments). ***Financial Analysis*** - Ratios- Liquidity, Leverage, Profitability and Activity Ratios (Simple Problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept and convention and significance of accounting. (L1)
- Apply the fundamental knowledge of accounting while posting the Journal entries. (L3)
- Analyze the process and preparation of Financial Accounts and Financial Ratios. (L4)
- Evaluate the Financial performance of an enterprise by using financial statements. (L5)

TEXTBOOKS:

1. "Managerial Economics", Varshney & Maheswari, S. Chand, 2013.
2. "Managerial Economics and Financial Analysis", Aryasri, MGH, 4th edition, 2019

REFERENCE BOOKS:

1. "Managerial economics", Ahuja HL, S. Chand, 3rd edition, 2013.
2. "Managerial Economics and Financial Analysis", S. A. Siddiqui and A. S. Siddiqui, New Age International, 2013.
3. "Principles of Business Economics", Joseph G. Nellis and David Parker, Pearson, 2nd edition, New Delhi.
4. "Managerial Economics in a Global Economy", Dominick Salvatore, Cengage Learning, 2013.

Course Code	PYTHON PROGRAMMING & DATA SCIENCE LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050307			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- Practical understanding of building different types of models and their evaluation

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Illustrate the use of various data structures. (L3)
CO2: Analyze and manipulate Data using Pandas (L4)
CO3: Creating static, animated, and interactive visualizations using Matplotlib. (L6)
CO4: Understand the implementation procedures for the machine learning algorithms. (L2)
CO5: Apply appropriate data sets to the Machine Learning algorithms (L3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Week 1
Write a program to demonstrate a) Different numeric data types and b) To perform different Arithmetic Operations on numbers in Python.

Week 2
Write a program to create, append, and remove lists in Python.

Week 3
Write a program to demonstrate working with tuples in Python.

Week 4
Write a program to demonstrate working with dictionaries in Python.

Week 5
Write a program to demonstrate a) arrays b) array indexing such as slicing, integer array indexing and Boolean array indexing along with their basic operations in NumPy.

Week 6
Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.

Week 7
Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be the input that to be written to the second file.

Week 8
Write a program to demonstrate Regression analysis.

Week 9
Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Week 10
Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file.

Week 11
Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.

Week 12
Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.

Week 13
Write a program to build Artificial Neural Network and test the same using appropriate data sets.

TEXTBOOKS:

1. "Deep Learning with Python", Francois Chollet, Manning Publications Company, 1/e, 2017.
2. "How to Think Like a Computer Scientist: Learning with Python 3", Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, 3rd edition. URL: http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. "Head First Python a Brain Friendly Guide", Paul Barry, O'Reilly, 2nd Edition, 2016
4. "Pandas for Everyone Python Data Analysis", Daniel Y. Chen, Pearson Education, 2019

Course Code	SOFTWARE ENGINEERING & OOAD LAB		L	T	P	C
21A050411	(Common to CSE, CSE-AI, AIML, CSE-IOT)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To Learn and implement the fundamental concepts of software Engineering.
- To explore functional and non-functional requirements through SRS.
- To practice the various design diagrams through appropriate tool.
- To learn to implement various software testing strategies.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the basic concepts of Software Engineering.
CO2: Identify basic issues in software requirements analysis and specification
CO3: Apply the structured, object-oriented analysis and design (SA/SD) technique.
CO4: Design test cases for black box and white box testing.
CO5: Learn and practice project planning activities.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2

SE LAB Experiments List

Week-1

Draw the Work Breakdown Structure for the system to be automated

Week-2

Using COCOMO model estimate effort.

Week-3

a) Calculate effort using FP oriented estimation model.
b) Analyze the Risk related to the project and prepare RMMM pla

Week-4

Develop Time-line chart and project table using PERT or CPM project scheduling methods.

Week-5

Draw E-R diagrams, and DFD for the project.

Design of Test cases based on requirements and design.

Week-6

Test a piece of code which executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.

Week-7

a) Test the percentage of code to be tested by unit test using any code coverage tools

b) Write C/C++/Java/Python program for classifying the various types of coupling.

Week-8

a) Write a C/C++/Java/Python program for classifying the various types of cohesion.

b) Write a C/C++/Java/Python program for object-oriented metrics for design proposed Chidamber and kremer. (Popularly called as CK metrics)

OOAD LAB Experiments List

Take three case studies:

- Customer Support System (in the Object-Oriented Analysis & Design with the Unified Process by Satzinger, Jackson & Burd Cengage Learning)
- Point-Of-Sale Terminal (in Larman textbook)
- Library Management System (in the reference book no. 2 i.e., UML toolkit)

Week-9

Familiarization with Rational Rose or *UML

Week-10

For each case study:

a) Identify and analyse events

b) Identify Use cases

Week-11

For each case study:

a) Develop event table

b) Identify & analyse domain classes

Week-12

For each case study:

a) Represent use cases and a domain class diagram using Rational Rose

b) Develop CRUD matrix to represent relationships between use cases and problem domain classes

Course Code	COMPUTER NETWORKS & OPERATING SYSTEMS LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050412			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To understand the working of character and bit stuffing
- To understand the Dijkstra's algorithm and its performance
- To analyze the performance of DES encryption algorithms
- To understand CPU scheduling algorithms and page replacement algorithms

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand how data is transmitted and checking of errors. **(K2)**

CO2: Understand Inter process communication including shared memory, pipes and messages **(K2)**

CO3: Simulate CPU Scheduling Algorithms. (FCFS, RR, SJF, Priority, Multilevel Queuing) **(K6)**

CO4: Simulate Banker's Algorithm for Deadlock Avoidance, Prevention Program for FIFO, LRU, and OPTIMAL page replacement algorithm. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2

PART-A

Week 1

Implement the data link layer framing methods such as character, character stuffing and bit stuffing.

Week 2

Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.

Week 3

Implement Dijkstra 's algorithm to compute the Shortest path thru a graph.

Week 4

a) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

b) Take an example subnet of hosts. Obtain broadcast tree for it.

Week 5

a) Take a 64-bit playing text and encrypt the same using DES algorithm.

b) Write a program to break the above DES coding

Week 6

Using RSA algorithm Encrypt a text data and Decrypt the same.

PART-B

Week7

Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority

Week 8

Simulate all file allocation strategies a) Sequential b) Indexed c) Linked

Week 9

Simulate MVT and MFT

Week 10

Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG

Week 11

a) Simulate Bankers Algorithm for Dead Lock Avoidance

b) Simulate Bankers Algorithm for Dead Lock Prevention

Week 12

Simulate all page replacement algorithms a) FIFO b) LRU c) LFU Etc. …

Week 13

a) Simulate Paging Technique of memory management.

b) Experiments on fork, shared memory and semaphores

TEXTBOOKS:

1. "Introduction to Data Communications and Networking", Behrouz Forouzan, Tata McGraw Hill, 2015, 5th Edition.
2. "Data and Computer Communications", Stallings, PHI, 2015, 10th Edition.

REFERENCE BOOKS:

1. "Data Communication", William Schewber, McGraw Hill, 1987.
2. "Computer Networks", Tanenbaum, PHI, 5th Edition, 2011.
3. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, John Wiley, Eight Edition
4. "Operating Systems: Internals and Design Principles", Stallings, Pearson Education, Sixth Edition, 2009.
5. "Modern Operating Systems", Andrew S Tanenbaum, PHI, Second Edition.

ONLINE LEARNING RESOURCES:

1. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
2. http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm
3. http://iit.qau.edu.pk/books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
4. http://www.networkdictionary.com/protocols/osimodel.php

Course Code	ADVANCED JAVA		L	T	P	C
21A050703	(Common to CSE, CSE-AI, AIML, CSE-IOT)		1	0	2	0
Pre-requisite	C Programming & Data Structures	Semester	IV			

COURSE OBJECTIVES:

- The course is designed to provide programming fundamentals using JAVA

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Implement object-oriented programming concepts
CO2: Use and create package and interfaces in a java program.
CO3: Understanding of advance website development tools.
CO4: Use Graphical user interface in java program.
CO5: Creates applets.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	2	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	2	-	-	-	-	-	3	3	-	2

Topics to be covered

1. **Introduction of OOPs:** Summarized overview of Object-Oriented programming Technique.

2. **Class and its objects:** Define class and its object, Constructor, types of Constructors, Default Constructor, method over loading, constructor overloading.

3. **Inheritance:** Define inheritance and its type. Constructor in inheritance, super keyword, method overriding.

4. **Package and interface:** Define Package, how to use it, how to access multiple inheritance using interface, dynamic binding

5. **Variables and Inner Classes:** Types of variables, use of static keyword, Inner classes and its importance.

6. **Exception Handling:** Define Exception, how to handle exception, checked and unchecked exception, custom exception, try, catch and finally keywords.

7. **Java I/O:** How to take input from different devices. Hierarchy of java io class.

8. **String:** String methods, StringBuffer class and its methods.

9. **Multithreading:** Creating thread and running it, Multiple Thread acting on single object, Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread.

10. **applets:** Defining the applet and Applet class, life cycle of applets, Font class, Graphics.

11. **Event Handling:** Define Event and its class, Listener, Adapter, MouseListener, MouseMotionListener, KeyListener.

12. **Swing and its Component Layout:** Swing components and Container, different layout, FlowLayout, BorderLayout, GridLayout.

<u>Experiments List</u>

Week 1

Develop a Java Program to implement the concept OOP

Week 2

Develop a Java Program to implement the concept of Inheritance

Week 3

Develop a Java Program to implement the Packages & Interfaces

Week 4

Develop a Java Program to implement Exception handling

Week 5

Develop a Java Program to implement the concept of Java I/O

Week 6

Develop a Java Program to demonstrate Text File Reading and Writing

Week 7
Develop a Java Program to demonstrate the Strings handling

Week 8
Develop a Java Program to implement the concept Multithreading

Week 9
Develop a Java Program to implement the concept of applet

Week 10
Develop a Java Program to implement Event Handling

Week 11
Develop a Java Program to implement a Simple Calculator

Week 12
Develop a Java Program to demonstrate Swing and its Component Layout

REFERENCE BOOKS:

1. "SCJP Sun Certified Programmer", Kathy Sierra and Bert Bates
2. "The Complete Reference", TMH.
3. "Java SE8 for Programmers", Paul Deitel and Harvey Deitel, Deitel Developer Series, 3rd Edition
4. www.tutorialspoint.com/java/
5. www.javatpoint.com/java-tutorial
6. www.udemy.com/java-tutorial/

Course Code	THEORY OF COMPUTATION		L	T	P	C
21A050413	(Common to CSE, CSE-AI, AIML)		3	0	0	3
Pre-requisite	Mathematical Foundations of Computer Science	Semester	V			

COURSE OBJECTIVES:

- To introduce languages, grammar, and computational models.
- To explain the Context Free Grammars.
- To enable the students to use Turing machines.
- To demonstrate decidability and un-decidability for NP-Hard problems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Finite Automata and its applications. **(K2)**
CO2: Understand Regular Expressions and its applications. **(K2)**
CO3: Understand Context Free Grammar and its applications. **(K2)**
CO4: Understand Push-Down Automata and its applications. **(K2)**
CO5: Design Turing Machines and Understand Decidability and Un-decidability problems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	-	-
CO4	2	2	2	2	2	-	-	-	-	-	-	-	-	-
CO5	1	1	2	1	2	-	-	-	-	-	-	3	-	2

UNIT – I (10 Hrs)

Finite Automata: The Central Concepts of Automata Theory, Finite Automata, Transition Systems, Acceptance of a String by a Finite Automata, DFA, Design of DFAs, NFA, Design of NFAs, Finite Automata with Ɛ-Transition, Conversions and Equivalence Between Ɛ-NFA, NFA and DFA, Minimization of Finite Automata, Equivalence between Two DFAs, Mealy and Moore Machines, Applications and Limitation of Finite Automata.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology in Finite Automata (L2)
- Design Finite Automata (L4)
- Solve basic problems in Finite Automata (L3)

UNIT – II (9 Hrs)

Regular Expressions: Regular Expressions, Regular Sets, Identity Rules, Equivalence of two Regular Expressions, Manipulations of Regular Expressions, Conversions and Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closure Properties, Applications of Regular Expressions, Finite Automata and Regular Grammars, Regular Expressions and Regular Grammars.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology in Regular Expressions. (L2)
- Understand Applications of Regular Expressions (L2)
- Solve basic problems in Regular Expressions (L3)

UNIT – III (9 Hrs)

Context Free Grammars: Formal Languages and Grammars, Chomsky Hierarchy of Languages and its Recognizers, Context-Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, Ɛ-Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of Context Free Grammars (L2)
- Understand applications of Context Free Grammars (L2)
- Solve basic problems in Context Free Grammars (L3)

UNIT – IV (9 Hrs)

Pushdown Automata: Definition, Model, Graphical Notation, Instantaneous Description Language, Acceptance of pushdown Automata, Design of Pushdown Automata, Deterministic and Non-Deterministic Pushdown Automata, Conversions and Equivalence between Pushdown Automata and Context Free Grammars, Two Stack Pushdown Automata, Application of Pushdown Automata

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of Push Down Automata (L2)
- Design Push Down Automata (L6)
- Solve basic problems in Push Down Automata (L3)

UNIT – V (8 Hrs)

Turing Machines: Definition, Model, Representation of Turing Machines-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a Turing Machine, Design of Turing Machines, Techniques for Turing Machine Construction, Types of Turing Machines, Church's Thesis, Universal Turing Machine, Restricted Turing Machine.

Decidable and Un-decidable Problems: P, NP, NP-Hard and NP-Complete Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology in Turing Machines (L2)
- Design Turing Machines (L4)

- Understand Decidable and Un-decidable Problems (L2)

TEXTBOOKS:

1. "Introduction to Automata Theory, Languages and Computation", J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008.
2. "Theory of Computer Science-Automata, Languages and Computation", K. L. P. Mishra and N. Chandrasekaran, 3rd Edition, PHI, 2007.

REFERENCE BOOKS:

1. "Formal Language and Automata Theory", K. V. N. Sunitha and N. Kalyani, Pearson, 2015.
2. "Introduction to Automata Theory, Formal Languages and Computation", Shyamalendu Kandar, Pearson, 2013.
3. "Theory of Computation", V. Kulkarni, Oxford University Press, 2013.
4. "Theory of Automata, Languages and Computation", Rajendra Kumar, McGraw Hill, 2014.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106106049/
2. https://nptel.ac.in/courses/106104028

Course Code	SOFTWARE TESTING (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050414			3	0	0	3
Pre-requisite	Software Engineering & OOAD	Semester	V			

COURSE OBJECTIVES:

- To understand what is testing? and Software development model.
- To describe different approaches to Testing and testing methodologies.
- To demonstrate how to write and execute test plans
- To illustrate the basic concepts of automation testing
- To discuss about Test NG and other important concepts in automation testing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic concepts of testing and SDLC Models. **(K2)**
CO2: Examine STLC and different types of testing and defects. **(K3)**
CO3: Analyze automation testing and its elements and time functions. **(K4)**
CO4: Demonstrate different Popups in automation testing. **(K3)**
CO5: Analyze various Test NG Frameworks. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Manual Testing: Introduction, Error, Defect, Bug, Verification, Validation. Testing: Types of Testing, White box and Black box Testing. Software Development Life Cycle: Introduction to Software Development Life Cycle, Models for SDLC, Metrics for Projects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain types of testing, verification and validation concepts. (L2)
- Describe about Software Development Life Cycle. (L2)

UNIT – II (9 Hrs)

Software Testing Life Cycle: Basic Concepts of Software Testing Life Cycle, Testing Methodologies, Test Plans, Test Cases, Test Executions and Defect Reports. **Defects:** Types of Defects, Defect Life Cycle, Levels vs Builds, Priority and Severity. **Types of Testing:** Functionality Testing, Security Testing, Smoke Testing, Sanity Testing, Adhoc Testing, Exploratory Testing, Load Testing, Stress Testing, Regression Testing, Retesting.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about Software Testing Life Cycle. (L2)
- Examine various types of Testing and Defects. (L3)

UNIT – III (10 Hrs)

Automation Testing: Introduction to Selenium, Components in Selenium, Installation Process, Cross Browser, Parallel Testing, Web Driver Methods and Locators.

Working on the Elements: Links, Dropdown, Radio Buttons, Check Boxes, Web Tables, Actions. **Time Functions:** Implicit, Explicit, Page Load Functions, Scroll Functions.

Learning Outcomes*:* Student should be able to

- Analyze basic components in selenium (L4)
- Illustrate about different elements and time functions in selenium. (L3)

UNIT – IV (10 Hrs)

Working On Popups: Alerts, Prompts, Confirmation, Working on Frames and Windows, Introduction to Test NG Designs, Annotations in TestNG. Apache POI Jar Files 3.17 for Reading, Writing Excel Files. Page Object Model-Property List.

Learning Outcomes*:* Student should be able *to*

- Understand the popups in automation testing. (L2)
- Illustrate about TestNG Designs. (L3)

UNIT – V (11 Hrs)

Test NG Frameworks: Framework Designing Structure, Keyword Framework, Data Driven Framework, Linear Framework, Modular Framework, Hybrid Framework. Working on Maven Project – Creating Extent Reports, Basics of Github and Jenkins.

Learning Outcomes*:* Student should be able to

- Explain various kinds of Test NG Frameworks (L3)
- Describes Marven projects, Github and Jenkins. (L2)

TEXTBOOKS:

1. “Software Testing: Principles and Practices”, Srinivasan Desikan, Gopalaswamy Ramesh, 1st Edition, Pearson Education.
2. “Software Testing: Principles and Practices”, Naresh Chauhan, 2nd Edition, Oxford University Press

REFERENCE BOOKS:

1. “Software testing techniques”, Boris Beizer, Dreamtech, 2nd Edition, 2002.
2. “The craft of software testing”, Brian Marick, Pearson Education.
3. “Software Testing”, Yogesh Singh, Cambridge
4. “Software Testing”, P.C. Jorgensen , 3rd Edition, Aurbach Publications (Dist.by SPD).

Course Code	DESIGN & ANALYSIS OF ALGORITHMS			L	T	P	C
21A050415				3	0	0	3
Pre-requisite	Advanced Data Structures through C++	Semester		V			

COURSE OBJECTIVES:

- To demonstrate the importance of algorithms in computing.
- To explain the analysis of algorithms
- To illustrate the method of finding the complexity of algorithms
- To explain the advanced algorithm design and analysis techniques.
- To introduce special classes of algorithms NP – completeness and the classes P and NP.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the time complexity of an algorithm by solving the corresponding recurrence equation and apply the Divide and Conquer strategy to solve searching, sorting and matrix multiplication problems. **(K3)**

CO2: Analyze the efficiency of Greedy and Dynamic Programming design techniques to solve the optimization problems. **(K4)**

CO3: Apply Backtracking technique for solving constraint satisfaction problems. **(K3)**

CO4: Analyze the LC and FIFO branch and bound solutions for optimization problems, and compare the time complexities with Dynamic Programming techniques. **(K4)**

CO5: Define and Classify deterministic and Non-deterministic algorithms; P, NP, NP – hard and NP-complete classes of problems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-		
CO2	3	2	2	2	-	-	-	-	-	-	3	-		
CO3	3	2	3	2	-	-	-	-	-	-	-	3		
CO4	3	2	2	3	-	-	-	-	-	-	-	-		
CO5	3	3	2	2	-	-	-	-	-	-	-	-		

UNIT – I (9 Hrs)

Introduction: Algorithm, Algorithm specification, Performance analysis. Divide and Conquer: General method, Binary Search, Finding the maximum and minimum, Merge sort, Quick Sort, Strassen's matrix multiplication.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic ideas about algorithms (L4)
- Understand the concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation. (L4)

- Become familiar with a variety of sorting algorithms and their performance characteristics (eg, running time, stability, space usage) and be able to choose the best one under a variety of requirements. (L4)

UNIT – II (9 Hrs)

Greedy Method: General method, Knapsack problem, Job Scheduling with Deadlines, Minimum cost Spanning Trees, Optimal storage on tapes, Single-source shortest paths.

Dynamic programming: General Method, Multistage graphs, All-pairs shortest paths, 0/1 knapsack, the traveling salesperson problem.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Be able to use the design techniques introduced i.e. dynamic programming, greedy algorithm etc. to design algorithms for more complex problems and analyze their performance. (L5)
- Knowing and understanding a wide range of searching and sorting algorithms. (L5)

UNIT – III (9 Hrs)

Back tracking: General Method, 8 – queens problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles, Knapsack Problem.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Be able to use the design techniques introduced i.e. Backtracking to design algorithms for more complex problems and analyze their performance. (L4)

UNIT – IV (9 Hrs)

Branch and Bound: The method, Travelling salesperson, 0/1 Knapsack problem, Efficiency considerations. Lower Bound Theory: Comparison trees, Lower bounds through reductions – Multiplying triangular matrices, inverting a lower triangular matrix, computing the transitive closure.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Be able to use the design techniques introduced i.e. Branch and Bound, Lower Bound Theory to design algorithms for more complex problems and analyze their performance. (L4)

UNIT – V (8 Hrs)

NP – Hard and NP – Complete Problems: NP Hardness, NP Completeness, Consequences of being in P, Cook‘s Theorem, Reduction Source Problems.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Determine whether a graph has a Hamiltonian cycle. (L4)
- Determine whether a Boolean formula is satisfiable. (L4)

TEXTBOOKS:

1. "Fundamentals of Computer Algorithms", Ellis Horowitz, Sartaj Sahni and Rajasekaran, University Press, 2nd Edition, 2012.
2. "Design and Analysis of Algorithms", Parag Himanshu Dave and Himanshu Bhalchandra Dave, Pearson Education, 2nd Edition.

REFERENCE BOOKS:

1. "Introduction to the Design and Analysis of Algorithms", Anany Levitin, Pearson Education, 3rd Edition, 2012.
2. "Introduction to Algorithms", Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, PHI Learning Private Limited, 3rd Edition, 2012.
3. "Data Structures and Algorithms", Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Pearson Education, Reprint 2006.
4. "The Art of Computer Programming", Donald E. Knuth, Volumes 1& 3 Pearson Education, 2009.
5. "The Algorithm Design Manual", Steven S. Skiena, Springer, 2nd Edition, 2008.

ONLINE LEARNING RESOURCES:

1. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. http://www.facweb.iitkgp.ernet.in/~sourav/daa.html

Course Code	INFORMATION RETRIEVAL SYSTEMS (Common to CSE, CSE-AI, AIML)		L	T	P	C
21A050416			3	0	0	3
Pre-requisite	Data Base Management Systems	Semester	V			

COURSE OBJECTIVES:

- To demonstrate genesis and diversity of information retrieval situations for text and hyper media
- To describe hands-on experience store, and retrieve information from www using semantic approaches.
- To demonstrate the usage of different data/file structures in building computational search engines.
- To analyze the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia
- To analyze ranked retrieval of a very large number of documents with hyperlinks between them
- To demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the objectives of information retrieval systems **(K2)**

CO2: Examine models like vector-space, probabilistic and language models to identify the similarity of query and document. And to understand the method to construct thesauri automatically and manually **(K3)**

CO3: Illustrate natural language systems to build semantic networks for text **(K3)**.

CO4: Examine algorithms used for natural language processing **(K3)**

CO5: Estimate the measures to evaluate the performance of cross language information **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-	-	3	-		
CO2	-	3	2	-	-	-	-	-	-	-	2	-		
CO3	-	3	3	-	-	-	-	-	-	-	2	-		
CO4	2	-	-	3	-	-	-	-	-	-	-	2		
CO5	2	-	3	-	2	-	-	-	-	-	-	2		

UNIT – I (9 Hrs)

Introduction: Retrieval strategies: vector space model, Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language models.

Learning Outcomes: At the end of this unit, students should be able to

- Identify basic theories in information retrieval systems(L3)
- Identify the analysis tools as they apply to information retrieval systems(L2)

UNIT – II (9 Hrs)
Retrieval Utilities: Relevance feedback, clustering, N-grams, Regression analysis, Thesauri.
Learning Outcomes: At the end of this unit, students should be able to

- Evaluate search engines;(L4)
- Develop skills in problem solving using systematic approaches;(L3)
- Solve complex problems in groups and develop group work.(L3)

UNIT – III (9 Hrs)
Retrieval utilities: Semantic networks, parsing Cross –Language: Information Retrieval: Introduction, Crossing the Language barrier
Learning Outcomes: At the end of this unit, students should be able to

- Analyze performance of retrieval systems when dealing with unmanaged data sources (L4)
- Implement retrieval systems for web search tasks. (L3)
- Understand and apply the basic concepts of information retrieval (L4)

UNIT – IV (9 Hrs)
Efficiency: Inverted Index, Query processing, Signature files, Duplicate document detection.
Learning Outcomes: At the end of this unit, students should be able to

- Understand and apply the basic concepts of information retrieval; (L4)
- Appraise the limitations of different information retrieval techniques;(L4)
- Write programs to implement search engines;(L3)

UNIT – V (9 Hrs)
Integrating structured data and text. A historical progression, Information retrieval as relational application, Semi Structured search using a relational schema. Distributed Information Retrieval: A theoretical Model of distributed retrieval, web search
Learning Outcomes: At the end of this unit, students should be able to

- Analyze to research, understand and implement computer programs in the areas related to algorithms (L4)
- To estimate system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity (L5)

TEXTBOOKS:

1. "Information Retrieval Data Structures and Algorithms", W.B. Frakes, Ricardo Baeza-Yates, Prentice Hall, 1992.
2. "Modern Information Retrieval", Yates, Pearson Education.
3. "Information Storage & Retrieval", Robert Korfhage, John Wiley & Sons.

REFERENCE BOOKS:

1. "Information Retrieval Systems: Theory and Implementation", Kowalski, Gerald, Mark T Maybury, Kluwer Academic Press, 1997.
2. "Information retrieval Algorithms and Heuristics", Springer, 2nd Edition.

Course Code	SAP		L	T	P	C
21A050417	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Data Base Management Systems	Semester	V			

COURSE OBJECTIVES:

- To bridge the gap between the Academics and Industries
- To create job ready manpower resource pool with the skills of SAP
- To enhance employability by meeting the skill requirement of industry to address ever changing business needs.
- To build knowledge based Economy with cost effective program for World's best IT Company
- To understand industry best practices supported by SAP ERP – "Be future ready"

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the basic concepts of ERP (Enterprise Resource Planning) & SAP (Systems Applications and Products in Data Processing) **(K3)**

CO2: Analyze the SAP Net-Weaver Architecture for designing ABAP (Advanced Business Application Programming) **(K4)**

CO3: Categorize the various components of SAP & Client Administration **(K4)**

CO4: Solve the general administration and monitoring problems **(K3)**

CO5: Cconnect new versions of SAP like SAP HANA for Cloud Data. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	2	1	-	-	-	-	-	-	-	-	-	2
CO2	2	1	3	3	1	-	-	-	-	-	-	-	-	2
CO3	2	1	3	2	-	-	-	-	-	-	-	-	-	2
CO4	1	-	2	2	1	-	-	-	-	-	-	-	2	-
CO5	2	1	3	3	2	-	-	-	-	-	-	-	2	-

UNIT – I (9 Hrs)

ERP Introduction: ERP and its background, Different types of ERPs, Evolution of SAP, Different versions of SAP, New dimensional components of SAP, Modules of each SAP component.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basics concepts of ERP (L2)
- Understand the evolution and versions of SAP (L2)
- Analyse the various modules of SAP (L3)

UNIT-II (9 Hrs)

SAP Net-Weaver Architecture: NW Introduction, Components of NW & Core Architecture, Application servers, Central Instance, Dialog instance, ABAP and Java Stacks, Message servers, Dispatchers, WPs and the types, System Landscape

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the different components of NW (L3)
- Analyse the architecture of Net-Weaver (L3)
- Understand the ABAP and creating servers (L2)

<u>UNIT – III</u> (9 Hrs)

SAP Components: Core Component and functionality, Modules of SAP components, Roles in SAP application, Basis introduction to SAP technical work flow.

Client Administration: Client Concept, Create clients, Client Export/Import, Copy Logs, Monitoring of Client Copy

Learning Outcomes: At the end of this unit, students should be able to

Understand the components of SAP & Applications (L2)

- Analyse the workflow of SAP (L3)
- Plan the Client Administration like importing and exporting data (L5)

<u>UNIT – IV</u> (9 Hrs)

General Administration: Daily, weekly and monthly monitoring the system health, T-Codes related to System monitoring, Background Jobs administration, Spool architecture and administration, Performance tuning methods and implantation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the General monitoring and administration methods (L2)
- Analyse the spool architecture and administration (L3)
- Applying the performance monitoring methods (L3)

<u>UNIT – V</u> (8 Hrs)

Database administration: Oracle Database concepts, Monitoring Table spaces, SAPDBA/BR Tools, DB Activities and T-Codes, SAP HANA.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the database administration methods (L2)
- Analyse the SAPDBA Tools (L3)
- Comparing latest versions of SAP like SAP HANA (L2)

<u>TEXTBOOKS:</u>

1. “The Beginner’s Guide to sap”, Peter Moxon, SAPPROUK Limited
2. “SAP HANA: An Introduction”, Bjarne Berg, Penny Silvia, Galilio Press, 3rd Edition

<u>REFERENCE BOOKS:</u>

1. “SAP HANA 2.0: An Introduction”, Denys Van Kempen
2. “SAP HANA 2.0 Administration”, Bert Vanstechelman

3. "ABAP Development for SAP HANA (SAP PRESS)", Mohsin Ahmed, Sumit Naik, 1st Edition

Course Code	MOBILE COMPUTING		L	T	P	C
21A050418	(Common to CSE, CSE-AI, AIML, CSE-IOT)		**3**	**0**	**0**	**3**
Pre-requisite	Computer Networks	Semester	V			

COURSE OBJECTIVES:

- To understand mobile ad hoc networks, design and implementation issues, and available solutions
- To acquire knowledge of sensor networks and their characteristics

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the implementation issues in LANS and PANS of wireless networks.**(K3)**
CO2: Organizing and differentiating various MAC Protocols usage in Adhoc Wireless Networks. **(K4)**
CO3: Analyse Various Routing and Security Protocols in Wireless Networks.**(K4)**
CO4: Classification of QOS and Energy management in Wireless Networks.**(K4)**
CO5: Comparing various Protocols in wireless Sensor Networks and their characteristics. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	-	2
CO4	3	3	3	2	1	-	-	-	-	-	-	-	2	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Wireless LANS and PANS: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.

Wireless Internet: Wireless Internet, Mobile IP, TCP in Wireless Domain, WAP, Optimizing Web over Wireless.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish LANs, WLANs and PANS. (L5)
- Examine about IEEE 802 Standards, Hiperlans and Bluetooth. (L3)

UNIT – II (9 Hrs)

AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, AD Hoc Wireless Internet.

MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention –

Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

Learning Outcomes*:* At the end of this unit, students should be able to

- Illustrate about AD HOC Wireless Networks. (L3)
- Analyse MAC Protocols for Ad Hoc Wireless Networks. (L4)

UNIT – III (9 Hrs)

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding, Flooding: Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

Transport Layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks, Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand basic terminology of Routing Protocols. (L2)
- Explain different classifications of Routing Protocols. (L4)
- Illustrate various Transport Layer and Security Protocols. (L4)

UNIT – IV (9 Hrs)

Quality of Service: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks.

Energy Management: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand the Quality of Service in Ad Hoc Wireless Networks. (L2)
- Explain about Energy Management concepts in Wireless Networks. (L6)

UNIT – V (8 Hrs)

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Describe Wireless Sensor Networks. (L2)
- Explain various MAC Protocols for Wireless Sensor Networks. (L4)

TEXTBOOKS:

1. "Ad Hoc Wireless Networks: Architectures and Protocols", C. Siva Ram Murthy and B. S. Manoj, PHI, 2004.
2. "Wireless Ad-hoc and Sensor Networks: Protocols, Performance and Control", Jagannathan Sarangapani, CRC Press.

REFERENCE BOOKS:

1. "Ad hoc Mobile Wireless Networks", Subir Kumar sarkar, T G Basvaraju, C Puttamadappa, Auerbach Publications, 2012.
2. "Wireless Sensor Networks", C. S. Raghavendra, Krishna M. Sivalingam, Springer, 2004.
3. "Ad-Hoc Mobile Wireless Networks: Protocols & Systems", C.K. Toh, Pearson Education.

<table>
<tr><td>Course Code</td><td rowspan="2">SOFTWARE TESTING LAB
(Common to CSE, CSE-AI, AIML, CSE-IOT)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A050419</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Pre-requisite</td><td>Object Oriented Programming through Java</td><td>Semester</td><td colspan="4">V</td></tr>
</table>

COURSE OBJECTIVES:

- To understand the fundamentals for various testing methodologies.
- To describe the principles and procedures for designing test cases.
- To explore debugging methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the basic testing procedures. **(K2)**

CO2: Formulate test cases and test suites **(K6)**

CO3: Choose Selenium tools to perform testing **(K3)**

CO4: Construct and test simple programs. **(K6)**

CO5: Describe bug tracking **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	-	-	-	-	3	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	2	-	-	-	-	-	-	2	1
CO4	3	-	2	-	-	-	-	-	-	-	-	-	2	-
CO5	-	3	3	-	-	2	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

MANUAL TESTING: (USING C LANGUAGE)

1. Write a ‘C’ program to demonstrate the working of the following constructs:

a). do…while

b). while

c). if …else

d). switch

e). for Loops in C language.

2. A program written in c language for matrix multiplication fails “Introspect the causes for its failure and write down the possible reasons for its failure”.
3. Take any system (e.g. ATM system) and study its system specifications and report the various bugs.
4. Write the test cases for any known application (e.g. Banking application)
5. Create a test plan document for any application (e.g. Library Management System).

AUTOMATION TESTING: (using Selenium)

1. Write a script to open google.com and verify that title is Google and also verify that it is redirected to google.co.in.
2. Write a script to open google.co.in using chrome browser (ChromeDriver).
3. Write a script to open google.co.in using internet explorer (InternetExplorerDriver).
4. Write a script to login Next Generation Automation.
5. Write a script to close all the browsers without using quit() method.
6. Write a script to test the cookie creation.
7. Write a script to test the Gmail Login & Logout procedure.
8. Write a script to test the Facebook Account Creation.
9. Write a script to test the Google Cache Selection.
10. Write a script to test the Gmail Composing Dynamically.

TEXTBOOKS:

1. "Software Testing: Principles and Practices", Srinivasan Desikan, Gopalaswamy Ramesh, 1st Edition, Pearson Education.
2. "Software Testing: Principles and Practices", Naresh Chauhan, 2nd Edition, Oxford University Press
3. "Java Complete Reference", Herb Schildt, 9th Edition, Oracle press.

Course Code	DESIGN & ANALYSIS OF ALGORITHMS LAB		L	T	P	C
21A050420			0	0	3	1.5
Pre-requisite	Advanced Data Structures through C++	Semester	V			

COURSE OBJECTIVES:

- To learn data structures for various applications.
- To implement different operations of data structures by optimizing the performance.
- To develop applications using Greedy, Divide and Conquer, dynamic programming.
- To implement applications for backtracking algorithms using relevant data structures.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply Greedy, divide and conquer algorithms. **(K3)**

CO2: Develop dynamic programming algorithms for various real-time applications. **(K3)**

CO3: Illustrate and apply backtracking algorithms, further able to understand non-deterministic algorithms. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	3
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	3

LIST OF EXPERIMENTS:

4. Write a program to implement the following operations on Binary Search Tree:
   a. a) Insert b) Delete c) Search d) Display
2. Write a program to perform a Binary Search for a given set of integer values.
3. Write a program to implement Merge sort for the given list of integer values.
4. Write a program to implement Quick sort for the given list of integer values.
5. Write a program to find the solution for the knapsack problem using the greedy method.
6. Write a program to find minimum cost spanning tree using Prim's algorithm.
7. Write a program to find minimum cost spanning tree using Kruskal's algorithm.
8. Write a program to find a single source shortest path for a given graph.
9. Write a program to find the solution for job sequencing with deadlines problems.
10. Write a program to find the solution for a 0-1 knapsack problem using dynamic programming.
11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
12. Implement Depth First Search Algorithm.

13. Write a program to solve Sum of subsets problem for a given set of distinct numbers using backtracking.
14. Implement N Queen's problem using Back Tracking.

REFERENCE BOOKS:

1. “Introduction to Programming using Python”, Y Daniel Liang, Pearson.
2. “Python Data Structures and Algorithms”, Benjamin Baka, David Julian, Packet Publishers, 2017.
3. “Data Structures and Algorithms using Python”, Rance D. Necaise, Wiley Student Edition.

ONLINE LEARNING RESOURCES:

1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

Course Code	AMAZON WEB SERVICES		L	T	P	C
21A050704	(Common to CSE, EEE)		1	0	2	2
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To apply Concept of AWS to implement cloud computing.
- To illustrate the basic AWS Concepts
- To demonstrate the use of AWS Concepts of cloud computing.
- To discuss the implementation of AWS services such as EC2, S3, Load Balancer etc
- To familiarize with cloud deployments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze a cloud computing attributes and implementing different cloud storages. **(K4)**

CO2: Create a S3 bucket for universal data storage, Building a load balancer & VPC for traffic routing. **(K6)**

CO3: Deploying different types of web applications into cloud servers. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	2

LIST OF EXPERIMENTS:

Week 1:

Creation of an AWS account and implementing EC2 services. Login into www.amazonconsole.com and creating a free tier account with individual mail id. Provide proper authentication with the help of credit card and creating instances.

Week 2:

Inspecting all the components of a AWS such as computing, routing, deploying , data storage and creating instances for every option. Monitoring the security aspects in the form of Security groups and creating security groups.

Week 3:

Analysing the different cloud storages such as S3 bucket, EBS. Creating a bucket in S3 and uploading different files in to the S3 bucket. Creating an EBS storage block and uploading bulk data.

Week 4:

The cloud computing is completely depends on networking and the traffic, the traffic must have proper balancing to avoid colloid. We are going to create a Load Balancer with proper traffic diversion rules (X canary) will be implemented for traffic switch.

Week 5:

Virtual Private cloud is one of the major important aspect for Cloud communication. VPC establish a communication between 2 or more private are public cloud. The VPC contains subnets. We can create VPC and subnets in AWS. Implementing the routing table to regularize the traffic.

Week 6:

Security is a major challenging in cloud computing. Security groups are used to create security rolls for the users. creating a security group and adopting different security rules for the cloud services.

Week 6, 7& 8

Implement the following cloud computing applications.

A) Create an account with your individual mail id.
B) Connect the EC2 server with the browser by using SSH Key .
C) Implement LINUX commands in the AWS server.
D) Create a security group and download security key.
E) Implement different security roles for the users
F) Create an S3 bucket and upload the different files .txt, .php, .json etc.
G) Create a VPC and subnets to implement traffic switching.
H) Create a load balancer and route the traffic to balance the servers.

Week 9&10

Create a project by using HTML / PHP /Json and upload the project into the server. Verify the accessing of website through IP address. The domain name should be selected and access the uploaded website with its domain naming address. (http://www.google.com).

TEXTBOOKS:

1. "AWS: Ultimate guide to Amazon Web Services", Robert M. Ferrana, Kindle Publications

Course Code	UNIVERSAL HUMAN VALUES (Common to all branches)		L	T	P	C
21A000003			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the significance and need of values in the society. **(K2)**

CO2: Understand the meaning of Harmony in the Self the Co-existence of Self and Body. **(K2)**

CO3: Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society **(K2)**

CO4: Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. **(K3)**

CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-

UNIT – I (9 Hrs)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the significance and need of values in the society. (L2)

UNIT – II (9 Hrs)

Understanding Harmony in the Human Being - Harmony in Myself: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programs to ensure self-regulation and Health.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the meaning of Harmony in the Self the Co-existence of Self and Body. (L2)
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. (L2)

UNIT – III (9 Hrs)

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order

Learning Outcomes: At the end of this unit, students should be able to

- Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society (L2)

UNIT – IV (9 Hrs)

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at all Levels, and the Holistic Perception of Harmony in Existence.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. (L3)

UNIT – V (9 Hrs)

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Learning Outcomes: At the end of this unit, students should be able to

- Identify the scope and characteristics of people friendly and eco-friendly production systems. (L2)

- Develop appropriate technologies and management patterns for above production systems. (L3)
- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. (L3)

TEXTBOOKS:

1. "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

REFERENCE BOOKS:

1. "Jeevan Vidya: Ek Parichaya", A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. "Human Values", A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. "The Story of My Experiments with Truth", Mohandas Karamchand Gandhi
5. "Small is Beautiful", E. FSchumacher.
6. "Slow is Beautiful", Cecile Andrews
7. "Economy of Permanence", J C Kumarappa
8. "Bharat Mein Angreji Raj", Pandit Sunderlal
9. "Rediscovering India", Dharampal,
10. "Hind Swaraj or Indian Home Rule", Mohandas K. Gandhi,
11. "India Wins Freedom", Maulana Abdul Kalam Azad
12. "Vivekananda", Romain Rolland (English)
13. "Gandhi", Romain Rolland (English)

ONLINE LEARNING RESOURCES:

1. http://www.uhv.org.in/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://www.studocu.com/in/document/dr-apj-abdul-kalam-technical-university/universal-human-valuestechnical-communication/uhv-best-notes/31376289

Course Code	ARTIFICIAL INTELLIGENCE		L	T	P	C
21A050421	(Common to CSE, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To define Artificial Intelligence and establish the cultural background for study
- To understand various learning algorithms
- To explore the searching and optimization techniques for problem solving
- To provide basic knowledge on Natural Language Processing and Robotics

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply searching techniques for solving a problem **(K4)**
CO2: Design Intelligent Agents **(K3)**
CO3: Develop Natural Language Interface for Machines **(K3)**
CO4: Design mini robots **(K3)**
CO5: Summarize past, present and future of Artificial Intelligence **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	1	-	-	-	-	-	-	2
CO2	3	3	3	2	1	1	-	-	-	-	-	-	-	2
CO3	2	3	3	2	1	-	-	-	-	-	-	-	2	2
CO4	3	3	2	2	1	-	-	-	-	-	-	-	2	-
CO5	3	3	2	2	1	-	-	-	-	-	-	-	2	-

UNIT – I (9Hrs)

Introduction: What is AI, Foundations of AI, History of AI, The State of Art. **Intelligent agents**: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the history of Artificial Intelligence (L2)
- Analyse the nature of Agent behaviour and its environment (L3)
- Recognize rationality of agent working (L2)
- Identify the requirement to implement agent structure (L2)

UNIT – II (10 Hrs)

Solving problems by searching: Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, **Beyond Classical Search:** Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the searching methodology using agents (L2)
- Differentiate informed and uninformed search strategies (L3)
- Apply search strategy in non-deterministic environment (L4)
- Use agents to solve complex searching problems (L3)

UNIT – III (9 Hrs)

Reinforcement learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL **Natural language processing**: Language Models, Text Classification, Information Retrieval, Information Extraction.

Learning Outcomes: At the end of this unit, students should be able to

- Examine how an agent can learn from success and failure, reward and punishment (L5)
- Compare and apply active and passive types of reinforcement learning (L3)
- Apply Natural Language Processing in Text, Information retrieval and Extraction systems (L4)

UNIT – IV (9 Hrs)

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition **Perception**: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

Learning Outcomes: At the end of this unit, students should be able to

- Use natural language for augmenting grammars, speech recognition and syntactic analysis (L5)
- Identify the object, image using perception concepts (L3)
- Develop programs that translate from one language to another, or recognize spoken words. (L6)
- Recognize the structural information using Vision concepts (L3)

UNIT – V (8 Hrs)

Robotics: Introduction, Robot Hardware, Robotic Perception, planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains **Philosophical Foundations**: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the Robotics architecture and its working in real world applications (L2)
- Apply robotics operations in different application domains (L5)
- List the main philosophical issues in AI. (L1)
- Analyse various variations in strong and weak AI (L4)

TEXTBOOKS:

1. "Artificial Intelligence A Modern Approach", Stuart J. Russell, Peter Norvig, Pearson Education, 3rd Edition, 2019.

REFERENCE BOOKS:

1. "Artificial intelligence: a new synthesis", Nilsson, Nils J., and Nils Johan Nilsson, Morgan Kaufmann, 1998.
2. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence", Johnson, Benny G., Fred Phillips, and Linda G. Chase, Journal of Accounting Education, 2009

Course Code	MOBILE APPLICATION DEVELOPMENT		L	T	P	C
21A050422	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of android operating systems.
- To illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify mobile application development software development tools. **(K3)**
CO2: Analyse various widgets in mobile applications**. (K3)**
CO3: Compare various layouts in mobile application design. **(K3)**
CO4: Utilize multimedia, camera and Location based services in Android App. **(K3)**
CO5: Build mobile application with dialogs and Fragments and Design and develop menus with database in mobile applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	3	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3

UNIT – I (9 Hrs)

Introduction to Android: The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Android architecture. (L3)
- Summarize the various features for Android (L2)

UNIT – II (9 Hrs)

Basic Widgets: Understanding the Role of Android Application Components, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the

User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the basic Widgets (L4)
- Discover the Need for Event Handling in different Mobile Applications (L3)
- Choose the controls for the mobile Applications (L3)

UNIT – III (9 Hrs)

Building Blocks for Android Application Design: Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation.

Utilizing Resources and Media: Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video, Displaying Progress with Progress Bar, Using Assets.

Learning Outcomes: At the end of this unit, students should be able to

- Choose the building blocks for Android Application Design (L3)
- Select the resources and media for the mobile Applications (L3)
- Illustrating the mobile design (L4)

UNIT – IV (9 Hrs)

Using Selection widgets and Debugging: Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control, Using the Debugging Tool: Dalvik Debug Monitor Service(DDMS), Debugging Application, Using the Debug Perspective.

Displaying And Fetching Information Using Dialogs and Fragments: What Are Dialogs?, Selecting the Date and Time in One Application, Fragments, Creating Fragments with java Code, Creating Special Fragments

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the debugging process (L3)
- Choose the selection widgets for mobile applications (L3)
- Illustrate Dialogs and Fragments (L4)

UNIT – V (9 Hrs)

Building Menus and Storing Data: Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar

Using Databases: Using the SQLite Open Helper class, Accessing Databases with the ADB, Creating a Data Entry Form,

Communicating with SMS and Emails: Understanding Broadcast Receivers, Using the Notification System, Sending SMS Messages with Java Code, Receiving SMS Messages, Sending Email, Working With Telephony Manager.

Learning Outcomes*:* At the end of this unit, students should be able to

- Create Menus and Storing Data (L6)
- Analyse Databases for mobile applications (L4)
- Analyse Communications with SMS and Emails (L4)

TEXTBOOKS:

1. "Android Programming", B.M Harwani, Pearson Education, 2013

REFERENCE BOOKS:

1. "Android application Development for Java Programmers", James C Sheusi, Cengage Learning
2. "Android In Action", W. Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz., Dreamtech.
3. "Professional Android 4 applications development", Reto Meier, Wiley India, 2012.
4. "Beginning Android 4 applications development", Wei Meng Lee, Wiley India,2013
5. "Beginning Android Development: Create Your Own Android", PawPrints Learning Technologies, Apps Today, 2014.
6. "Android Programming: Pushing the Limits", Erik Hellman, John Wiley and sons ltd, 2014.
7. "Introduction to Android Application Development", Joseph Annuzzi, Jr, Lauren Darcey, Addison-Wesley, 4th Edition.

<table>
<tr><td>Course Code</td><td rowspan="2">CLOUD COMPUTING
(Common to CSE, CSE-AI, AIML)</td><td colspan="2">L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A050423</td><td colspan="2">3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Database Management Systems, Python Programming and Data science</td><td>Semester</td><td colspan="4">VI</td></tr>
</table>

COURSE OBJECTIVES:

- Define cloud services and models
- Demonstrate design the architecture for new cloud application.
- Explain how to re-architect the existing application for the cloud.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate Fundamentals of Cloud Computing **(K3)**

CO2: Analyze Cloud Services, Platforms and Map Reduce Framework **(K4)**

CO3: Examine the Cloud Application Design and Live Apps **(K3)**

CO4: Analyze Python usage for Cloud Platforms and Django Framework **(K4)**

CO5: Illustrate Cloud Application Development in Python **(K3)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction to Cloud Computing: Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing.

Learning Outcomes: At the end of this unit, students should be able to:

- Outline the Cloud characteristics and models (L2)
- Classify different models, different technologies in cloud (L2)

UNIT – II (9 Hrs)

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and Management Services, Identity and Access Management Services, Open Source Private Cloud Software, Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.

Learning Outcomes: At the end of this unit, students should be able to:

- Summarize the Services and Platform of cloud (L3)
- Demonstrate Hadoop Cluster Setup (L4)

UNIT – III (9 Hrs)

Cloud Application Design: Design Considerations, Reference Architectures, Cloud Application Design Methodologies, Data Storage Approaches,

Multimedia Cloud: Introduction, Case Study: Live Video Streaming App, Streaming Protocols, Case Study: Video Transcoding APP.

Learning Outcomes: At the end of this unit, students should be able to:

- Design and build cloud applications (L3)
- Describe the multimedia cloud. (L2)

UNIT – IV (9 Hrs)

Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure, Python for MapReduce, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.

Learning Outcomes: At the end of this unit, students should be able to:

- Select different cloud services from different vendors (L3)
- Utilize Python language to access cloud services (L4)

UNIT – V (8 Hrs)

Cloud Application Development in Python, Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App, Cloud Application Benchmarking and Tuning, Cloud Security, Cloud Computing for Education.

Learning Outcomes: At the end of this unit, students should be able to:

- Investigate different Cloud applications. (L4)
- Design cloud applications using Python. (L4)

TEXTBOOKS:

1. “Cloud Computing A Hands-on Approach”, Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

REFERENCE BOOKS:

1. “Azure in Action”, Chris Hay, Brian Prince, Manning Publications, 2010.
2. “Introducing Windows Azure”, Henry Li, Apress, 1st Edition, 2009.
3. “Developing Applications for the Cloud on the Microsoft Windows Azure Platform” Matias Woloski, Microsoft Press, 1st Edition, 2010.
4. “Developing with Google App Engine”, Eugene Ciurana, Apress, 2009.
5. “Using Google App Engine”, Charles Severance, O'Reilly Media, 1st Edition, 2009.

Course Code	COMPETITIVE PROGRAMMING		L	T	P	C
21A050424			3	0	0	3
Pre-requisite	Advanced Data Structures through C++, Object Oriented Programming through Java	Semester	VI			

COURSE OBJECTIVES:

- To teach Competitive programming
- To discuss various computational problems and solutions
- To challenge the inherent talent of the student
- To make the student practice problem solving

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve problems related to Computer Science **(K3)**
CO2: Design innovative algorithms to problems (**K3)**
CO3: Acquire job ready skills **(K3)**
CO4: Develop problem solving and programming ability **(K4)**
CO5: Analyzing various graphics and bit manipulation problems **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	1	-	-	-	-	-	-	-	1	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	2	1	2	1	2	-	-	-	-	-	-	-	1	-
CO4	3	-	3	-	2	-	-	-	-	-	-	-	-	2
CO5	3	-	-	-	2	-	-	-	-	-	-	-	-	2

UNIT – I (9Hrs)

Programming for JOB : Why Programming Interviews Before the Search: Know Yourself, Know the Market, Develop Marketable Skills, Get things done, Manage your online profile.

The Job Application Process: Finding and contacting companies, the interview process, a recruiters role, Offers and Negotiation

The Phone Screen: Understanding Phone screens, How to take a phone screen, Phone screen problems. **Approaches to Programming Problems**: The process, Solving the problems, Analyzing your solution.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the Programming Skills based on the Current Market (L3)
- Identify the Job Application Process (L3)
- Solving the problems to get a Job (L4)

UNIT – II (9Hrs)

Fundamental Problems : Linked list problems, Tree and Graph problems, Array and String problems, Recursion problems, Sorting problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understands the concept of Linked Lists and its Applications (L3)
- Explain Trees and Graph Problems (L3)
- Solving the problems related to Arrays, String and Recursion (L4)

UNIT – III (10 Hrs)

Concurrency, Object-oriented programming : Concurrency: Basic Thread concepts, Concurrency problems. Object oriented programming: Fundamentals, Object oriented programming problems

Learning *Outcomes*: At the end of this unit, students should be able to

- Characterize the important aspect of Concurrency problems (L4))
- Explain the methods of using Threads in Programming (L3)
- Describe methods of using Object Oriented Programming (L3)

UNIT – IV (10 Hrs)

Design Patterns, Databases : What are Design patterns, Common design patterns, design patter problems. Data bases: Database fundamentals, Database problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Concept of Design Patterns (L3)
- Identify the common Design Pattern Problems (L3)
- Solving Problems using Design Patterns and Data Bases (L4)

UNIT – V (9 Hrs)

Graphics and Bit manipulation: Graphics, Bit manipulation, Graphics problems, Bit manipulation problems

Puzzles: Trackling Brainteasers, Brainteaser problems, Draw it first, Graphical and Spatial problems.

Learning Outcomes: At the end of this unit, students should be able to

- Identify Graphics and Bit Manipulation Problems (L3)
- Understand Puzzles Solving Problems (L3)
- Analyze Graphical and Spatial Problems (L4)

TEXTBOOKS:

1. "Programming Interviews Exposed", John Mongan, Noah Kindler, Eric Giguere, Fourth Edition, Wrox.

REFERENCE BOOKS:

1. "Guide to Competitive Programming", Antti Laaksonen, Springer

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs99/preview
2. https://www.coursera.org/learn/algorithms-part1
3. https://www.coursera.org/learn/algorithms-part2

Course Code	SOFTWARE PROJECT MANAGEMENT		L	T	P	C
21A050425	(Common to CSE, CSE-AI, AIML)		3	0	0	3
Pre-requisite	Software Engineering	Semester	VI			

COURSE OBJECTIVES:

- To understand the specific roles within a software organization as related to project and process management
- To learn the principles, techniques, methods & tools for model-based management of software projects, assurance of product quality and process adherence, as well as experience-based creation & improvement of models
- To understand the basic infrastructure competences like process modelling and measurement
- To analyse the basic steps of project planning, project management, quality assurance, and process management and their relationships

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop the model from the conventional software product to the modern **(K3)**

CO2: Apply, analyse, design and develop the software project and design various estimation levels of cost and effort **(K4)**

CO3: Sketch various artifacts sets for better understanding of software development **(K3)**

CO4: Compare and differentiate organization structures and project structures **(K4)**

CO5: Acquire the knowledge of managing, economics for conventional, modern and future software projects **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	2	-	-	-	-	-	-	-	2	-	3	-
CO2	2	3	2	-	2	-	-	-	-	-	-	-	3	2
CO3	-	-	-	-	2	-	-	-	1	-	-	-	-	-
CO4	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	1	-	-	2	-	3	2

UNIT – I (9 Hrs)

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Learning Outcomes: At the end of this unit, the students should be able to

- Prescribe the conventional and evolution of software (L3)
- Comprehend the process of managing software from conventional to modern (L2)
- Describe the evolution of software economics (L2)
- Evaluate budget for any small-scale projects(L4)

- Formulate various cost estimation models (L5)

<u>UNIT – II</u> (10 Hrs)

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process

Learning Outcomes: At the end of this unit, the students should be able to

- Analyze the importance of improving software economics (K4)
- Apply, design & develop the software system by transitioning to an process(K3)

<u>UNIT – III</u> (9 Hrs)

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

Model based software architectures: A Management perspective and technical perspective.

Learning Outcomes: At the end of this unit, the students should be able to

- Categorize different life cycle phases (L4)
- Analyze engineering and production stages(L4)
- Plan and manage projects at each stage of the SDLC(L5)
- Describe various artifact sets (L2)
- Analyze the architecture of a model based software and the process flow (L4)
- Illustrate different process planning strategies (L3)

<u>UNIT – IV</u> (9 Hrs)

Work Flows of the process: Software process workflows, Inter Trans workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Interaction planning process, Pragmatic planning.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Process Automation: Automation Building Blocks, The Project Environment

Learning Outcomes: At the end of this unit, the students should be able to

- Describe various workflows (L2)
- Summarize the check points of the process (L2)
- Develop the WBS structure of any project (L3)
- Describe the evolution of organization (L2)

UNIT – V (8 Hrs)

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates, Example.

Future Software Project Management: Modern Project Profiles Next generation Software economics, modern Process transitions.

Case Study: The Command Center Processing and Display System-Replacement (CCPDS-R)

Learning Outcomes: At the end of this unit, the students should be able to able to

- Identify seven core metrics (L4)
- Analyze the process automation, process management, and its discriminants (L4)
- Formulate metric automation (L5)
- Establish modern project profile (L2)
- Estimate future technologies of managing software projects (L4)
- Analyze next generation software economics (L4)

TEXTBOOKS:

1. "Software Project Management", Walker Royce, Pearson Education, 2012
2. "Software Project Management", Bob Hughes, Mike Cotterell and Rajib Mall, McGraw Hill Edition, 6th Edition, 2017

REFERENCE BOOKS:

1. "Software Project Management in practice", Pankaj Jalote, Pearson Education, 5^{th} Edition, 2017.
2. "Mastering Software Project Management: Best Practices, Tools and Techniques", Murali K. Chemuturi, Thomas M. Cagley Jr., J. Ross Publishing, 2010
3. "Software Project Management", Sanjay Mohapatra, Cengage Learning, 2011

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/106101061/29

<table>
<tr><td>Course Code</td><td rowspan="2">SOFT COMPUTING</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A050426</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>Nil   Semester</td><td colspan="4">VI</td></tr>
</table>

COURSE OBJECTIVES:

- To learn the fundamentals of Neural Networks & Feed Forward Networks.
- To understand Associative Memories & ART Neural Networks.
- To explain Fuzzy Logic & Systems.
- To learn Genetic Algorithms and Hybrid Systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Discuss about Fundamentals of Neural Networks techniques and their applications and Learn Back Propagation **(K2)**

CO2: Analyze Applications of HPF analyze various neural network architectures and ART Neural Networks. **(K4)**

CO3: Examine Fuzzy Logics and deFuzzification method. **(K3)**

CO4: Develop Basic algorithms of Genetic Algorithms, Offspring and Encoding. **(K3)**

CO5: Analyze Fuzzy Back Propagation Networks and the genetic algorithms and their applications using BPN **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	3		
CO2	3	3	3	2	-	-	-	-	-	-	2	-		
CO3	3	3	3	2	-	-	-	-	-	-	3	-		
CO4	3	2	3	3	-	-	-	-	-	-	3	-		
CO5	3	3	2	3	-	-	-	-	-	-	-	3		

UNIT – I (9 Hrs)

Fundamentals of Neural Networks & Feed Forward Networks: Basic Concept of Neural Networks, Human Brain, Models of an Artificial Neuron, Learning Methods, Neural Networks Architectures, Single Layer Feed Forward Neural Network: Architecture of a Back Propagation Network (BPN), The Solution, Back propagation Learning, Selection of various Parameters in BPN. Application of Back propagation Networks in Pattern Recognition & Image Processing

Learning Outcomes: At the end of this unit, the students should be able to

- Explain fundamentals of neural networks. (L2)
- Examine various models to implement neural networks. (L4)

UNIT – II (10 Hrs)

Associative Memories & ART Neural Networks: Basic concepts of Linear Associator, Basic concepts of Dynamical systems, Mathematical Foundation of Discrete-Time Hop field Networks (HPF), Mathematical Foundation of Gradient-Type Hopfield Networks, Transient response of Continuous Time Networks, Applications of HPF in Solution of Optimization Problem: Minimization of the Traveling salesman tour length, Summing networks with digital outputs, Solving Simultaneous Linear Equations.

Learning Outcomes: At the end of this unit, the students should be able to

- Identify the need for Associate Memories & ART Neural Networks (L3)
- Analyze the Applications of Hop field Networks. (L3)

UNIT – III (9 Hrs)

Fuzzy Logic & Systems: Fuzzy sets, Crisp Relations, Fuzzy Relations, Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule based system, Defuzzification Methods, Applications: Greg Viot's Fuzzy Cruise Controller, Air Conditioner Controller.

Learning Outcomes: At the end of this unit, the students should be able to

- Compare different types of Logic (L2)
- Choose a specific method to apply Fuzzy Logic & Systems (L5)

UNIT – IV (9 Hrs)

Genetic Algorithms: Basic Concepts of Genetic Algorithms (GA), Biological background, Creation of Offspring's, Working Principle, Encoding, Fitness Function, Reproduction, Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit-wise Operators used in GA, Generational Cycle, Convergence of Genetic Algorithm.

Learning Outcomes: At the end of this unit, the students should be able to

- Interpret the issues genetic algorithms (L2)
- Propose new genetic algorithms (L6)

UNIT – V (8 Hrs)

Hybrid Systems: Types of Hybrid Systems, Neural Networks, Fuzzy Logic, and Genetic Algorithms Hybrid, Genetic Algorithm based BPN: GA Based weight Determination, Fuzzy Back Propagation Networks: LR-type fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BPN, Inference by fuzzy BPN.

Learning Outcomes: At the end of this unit, the students should be able to

- Define the Hybrid Systems. (L1)
- Identify the need for security in Adhoc and Sensor networks. (L3)

TEXTBOOKS:

1. "Introduction to Artificial Neural Systems", J. M. Zurada, Jaico Publishers
2. "Neural Networks, Fuzzy Logic & Genetic Algorithms: Synthesis & Applications", S. Rajasekaran, G.A. Vijayalakshmi Pai, PHI, New Delhi, July 2011,
3. "Genetic Algorithms", David E. Gold Berg, Pearson Education India, 2006.
4. "Neural Networks & Fuzzy Systems", Kosko. B., PHI, Delhi,1994.

REFERENCE BOOKS:

1. "Artificial Neural Networks", Dr. B. Yagananarayana, PHI, New Delhi, 1999.
2. "An introduction to Genetic Algorithms", Mitchell Melanie, MIT Press, 1998
3. "Fuzzy Sets, Uncertainty and Information", Klir G.J. & Folger. T. A., PHI, Delhi, 1993

Course Code	**MOBILE APPLICATION DEVELOPMENT LAB** (Common to CSE, CSE-AI, AIML, CSE-IOT)		**L**	**T**	**P**	**C**
21A050427			**0**	**0**	**3**	**1.5**
Pre-requisite	Object Oriented Programming through Java	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of android operating systems.
- To illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Build a native application using GUI components and Mobile application Development **(K3)**

CO2: To demonstrate their skills of using Android software development tools and construct an application using multimedia **(K3)**

CO3: Explore the android studio IDE, Build mobile application with dialogs and Fragments and design, develop menus with database in mobile applications **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	-	1	2	2	1	1	-	2	3	3
CO2	3	2	2	-	-	1	2	2	1	1	-	2	3	3
CO3	3	2	2	-	-	1	2	2	1	1	-	2	2	3

LIST OF EXPERIMENTS:

1. Setting Up the Development Environment Download & Install the SDK and the SDK Platform Components
2. Create "Hello World" Application Create a new Android Project Run "Hello World" on the Emulator and On a Physical Device Greeting the User.
2. Create Application by Using Widgets Creating the Application by using the Activity class
   (i) onCreate() (ii) onStart() (iii) onResume() (iv) onPause() (v) onStop() (vi) onDestroy() (vii) onRestart()
3. Creating the Application by using Text Edit control.
4. Creating the Application Choosing Options
   (i) CheckBox (ii) RadioButton (iii) RadioGroup (iv) Spinner
5. Create Application by Using Building Blocks for Android Application Design. Design the Application by using
   (i) Linear Layout (ii) Relative Layout (iii) Absolute Layout

6. Create the Application to play the Audio and Video clips.
7. Create Application by Using Building Menus and Storing Data.
8. Design the Application for Menus and Action Bar.
9. Design the application to display the Drop-Down List Action Bar.

TEXTBOOKS:

1. "Android Programming", B.M Harwani, Pearson Education, 2013

Course Code	ARTIFICIAL INTELLIGENCE LAB		L	T	P	C
21A050428	(Common to CSE, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To explore the methods of implementing algorithms using artificial intelligence techniques
- To illustrate search algorithms
- To demonstrate building of intelligent agents

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Implement search algorithms **(K3)**

CO2: Solve Artificial intelligence problems **(K3)**

CO3: Design chatbot and virtual assistant **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	1	-	2	3	2	3	3	2
CO2	3	3	3	2	1	1	-	-	2	-	3	3	3	3
CO3	2	3	3	2	1	-	-	-	2	-	2	2	2	3

LIST OF EXPERIMENTS:

1. Write a program to implement DFS and BFS
2. Write a Program to find the solution for travelling salesman Problem
3. Write a program to implement Simulated Annealing Algorithm
4. Write a program to find the solution for wampus world problem
5. Write a program to implement 8 puzzle problem
6. Write a program to implement Towers of Hanoi problem
7. Write a program to implement A* Algorithm
8. Write a program to implement Hill Climbing Algorithm
9. Build a Chatbot using AWS Lex, Pandora bots.
10. Build a bot which provides all the information related to your college.
11. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
12. The following is a function that counts the number of times a string occurs in another string:

```
# Count the number of times string s1 is found in string s2
def countsubstring(s1,s2):
count = 0
for i in range(0,len(s2)-len(s1)+1):
```

if s1 == s2[i:i+len(s1)]:
count += 1
return count
For instance, countsubstring('ab','cabalaba') returns 2.
Write a recursive version of the above function. To get the rest of a string (i.e. everything but the first character).

13. Higher order functions. Write a higher-order function count that counts the number of elements in a list that satisfy a given test. For instance: count(lambda x: x>2, [1,2,3,4,5]) should return 3, as there are three elements in the list larger than 2. Solve this task without using any existing higher-order function.
14. Brute force solution to the Knapsack problem. Write a function that allows you to generate random problem instances for the knapsack program. This function should generate a list of items containing N items that each have a unique name, a random size in the range 1 .... 5 and a random value in the range 1 ..... 10.

    Next, you should perform performance measurements to see how long the given knapsack solver take to solve different problem sizes. You should perform at least 10 runs with different randomly generated problem instances for the problem sizes 10,12,14,16,18,20 and 22. Use a backpack size of 2:5 x N for each value problem size N. Please note that the method used to generate random numbers can also affect performance, since different distributions of values can make the initial conditions of the problem slightly more or less demanding.

    How much longer time does it take to run this program when we increase the number of items? Does the backpack size affect the answer? Try running the above tests again with a backpack size of 1 x N and with 4:0 x N.
15. Assume that you are organising a party for N people and have been given a list L of people who, for social reasons, should not sit at the same table. Furthermore, assume that you have C tables (that are infinitly large).

    Write a function layout(N,C,L) that can give a table placement (ie. a number from 0 : : :C -1) for each guest such that there will be no social mishaps.

    For simplicity we assume that you have a unique number 0 ......N-1 for each guest and that the list of restrictions is of the form [(X,Y), ...] denoting guests X, Y that are not allowed to sit together. Answer with a dictionary mapping each guest into a table assignment, if there are no possible layouts of the guests you should answer False.

ONLINE LEARNING RESOURCES:

1. Tensorflow: https://www.tensorflow.org/
2. Pytorch: https://pytorch.org/, https://github.com/pytorch
3. Keras: https://keras.io/, https://github.com/keras-team
4. Theano: http://deeplearning.net/software/theano/, https://github.com/Theano/Theano
5. Cafee2: https://caffe2.ai/, https://github.com/caffe2
6. Deeplearning4j: https://deeplearning4j.org/
7. Scikit-learn: https://scikit-learn.org/stable/, https://github.com/scikit-learn/scikit-learn
8. Deep Learning AI: https://www.deeplearning.ai/
9. OpenCv: https://opencv.org/, https://github.com/qqwweee/keras-yolo3
10. YOLO: https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/
11. nVIDIA CUDA: https://developer.nvidia.com/cuda-math-library
12. “Computational Intelligence : a logical approach”, David Poole, Alan Mackworth, Randy Goebel, Oxford University Press, 2004.
13. “Artificial Intelligence: Structures and Strategies for complex problem solving”, G. Luger, Pearson Education, 4th Edition, 2002.
14. “Artificial Intelligence: A new Synthesis”, J. Nilsson, Elsevier Publishers, 1998.
15. “Artificial Neural Networks”, B. Yagna Narayana, PHI
16. “Artificial Intelligence”, E. Rich and K. Knight, TMH, 2nd Edition.
17. “Artificial Intelligence and Expert Systems”, Patterson, PHI

Course Code	CLOUD COMPUTING LAB		L	T	P	C
21A050429	(Common to CSE, CSE-AI, AIML, CSE-IOT)		**0**	**0**	**3**	**1.5**
Pre-requisite	Database Management Systems, Python Programming and Data science	Semester	VI			

COURSE OBJECTIVES:

- To be familiar with developing web services/Applications.
- To learn to run SaaS Services
- To learn to run PaaS Services and virtual machines of different configuration

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design and Implement Web applications in Django Framework **(K4)**
CO2: Design and Run SaaS baes Application in Google Cloud **(K3)**
CO3: Program with PaaS Services on Microsoft Azure Cloud **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	-	2	2
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	3

LIST OF EXPERIMENTS:

I. Web Development using DJANGO Framework

a. Django Framework Packages Installation and Setting Environment to Run the Server
b. Python Program to develop Hello World Application in Django Framework
c. Python Program to develop Hello World Application in Django Framework with Templates
d. Python Program to develop Login Screen with Validation in Django Framework
e. Python Program to generate Prime Numbers up to a given number in Django Framework
f. Python Program to develop Login Screen with Validation in Django Framework using Data Bases

II. Programs on SaaS

a. Create a word document of your class time table and store locally and on the cloud with doc, and pdf format. (Use www.zoho.com and docs.google.com***)***
b. Create a spread sheet which contains employee salary information and calculate gross and total sal using the formula
DA=10% OF BASIC
HRA=30% OF BASIC

PF=10% OF BASIC IF BASIC<=3000
12% OF BASIC IF BASIC>3000
TAX=10% OF BASIC IF BASIC<=1500
=11% OF BASIC IF BASIC>1500 AND BASIC<=2500
=12% OF BASIC IF BASIC>2500
(Use www.zoho.com and docs.google.com)
NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX

c. Prepare a ppt on cloud computing –introduction, models, services and architecture. Ppt should contain explanations, images and at least 20 pages (Use www.zoho.com and docs.google.com)
d. Create your resume in a neat format using google and zoho cloud

III. Programs on PaaS

a. Develop Web Application to generate n even numbers and deploy it to Azure cloud
b. Develop Web Application to multiply two matrices deploy it to Azure cloud
c. Develop Web Application in php to validate login (username, password) and deploy to Azure cloud
d. Develop Web Application to display nth largest no from the given list of numbers and deploy it into Azure cloud
e. Develop Web Application in php to validate Login Screen using mysql data base and deploy it into Azure cloud

TEXTBOOKS:

1. "Cloud Computing A Hands-on Approach", Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

REFERENCE BOOKS:

1. "Azure in Action". Chris Hay, Brian Prince, Manning, 2010.
2. "Introducing Windows Azure", Henry Li, Apress, 1st Edition, 2009.
3. "Developing Applications for the Cloud on the Microsoft Windows Azure Platform", Matias Woloski, Microsoft Press, 1st Edition, 2010.
4. "Developing with Google App Engine", Eugene Ciurana, Apress, 1st Edition, 2009.
5. "Using Google App Engine", Charles Severance, O'Reilly Media; 1st Edition, 2009.

Course Code	PROGRAMMING IN C#		L	T	P	C
21A050705	(Common to CSE, CSE-AI, AIML, CSE-IOT)		1	0	2	2
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To apply Concept of C#.
- To illustrate the basic C# Concepts
- To demonstrate the use of C# in .Net framework.

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COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze a programming constructs of C# **(K3)**

CO2: Program with callback functions **(K3)**

CO3: Develop different types of applications in C# **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	2

LIST OF EXPERIMENTS:

Week I &2

Basic C# programs using the control structures and loops.

a) Hello world Program
b) Program to show the grade of a student. The marks of the student is taken as input
c) Factorial by recursion
d) Find the GCD

Week 3 & 4

Programs related to interfaces, Exceptions and Namespaces

a) Demonstrate use of Namespaces by simple program
b) Create an interface and write a class to implement it.
c) Demonstrate use of exception
d) Create a user defined Exception to show a message “under age” for those whose age is below i8 years.

Week 5 & 6

Programs on arrays, Enumerations and structs

Week 7 & 8

Programs on Delgates and Events

Week 9

Generics- stack, queue, delegates and events

Week 10 & 11

Implementing Design Pattens- Factory and singleton

TEXTBOOKS:

1. "Programming in C#", E. Balagurusamy, 3rd Edition

REFERENCE BOOKS:

1. "Programming C# 4.0", Ian Griffith, Matthew Adams, O'Reilly Publications, 6th Edition

ONLINE LEARNING RESOURCES:

1. www.javatpoint.com/c-sharp-tutorial
2. www.tutorialspoint.com/charp/index.htm

Course Code	RESEARCH METHODOLOGY (Common to all branches)		L	T	P	C
21A000004			2	0	0	0
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know how to define a Research problem, select suitable design and experimental approach. **(K1)**
CO2: Formulate sampling design and various techniques implemented on data collection. **(K6)**
CO3: Correlate any two variables and find the solution using regression analysis. **(K4)**
CO4: Examine hypothesis testing procedure, Analyze the significance of variance and covariance. **(K4)**
CO5: Write a report on research work for seminars, conferences formats. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (6 Hrs)

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of research and its process. (L2)
- Explain various types of research. (L2)
- Explain the steps involved in research design. (L2)
- Understand the different research approaches. (L2)

UNIT – II (6 Hrs)

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement –

Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of sampling and sampling design. (L2)
- Explain various techniques in measurement and scaling. (L2)
- Understand various methods of data collection. (L2)
- Design survey questionnaires for different kinds of research. (L3)
- Analyze the questionnaires. (L4)

UNIT – III (6 Hrs)

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of correlation and regression. (L2)
- Compare and contrast correlation and regression. (L3)
- Explain various types of correlation. (L3)
- Apply the knowledge of C&R Analysis to get the results. (L3)

UNIT – IV (6 Hrs)

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Understand the hypothesis testing procedure. (L2)
- Compare and contrast Parametric and Non-parametric Tests. (L3)
- Understand the use of chi-square test in investigating the distribution of categorical variables. (L2)
- Analyze the significance of variance and covariance. (L4)

UNIT – V (6 Hrs)

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how to write a report and research paper. (L2)
- Explain various techniques of interpretation. (L2)
- Understand the importance of professional ethics in research. (L2)

- Design a scientific paper to present in the conferences/seminars. (L3)

TEXTBOOKS:

1. "Research Methodology: Methods and Techniques", C.R.Kothari, New Age International Publishers, 2nd Edition,.
2. "Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, Sage Publications

REFERENCE BOOKS:

1. "Research Methodology and Statistical Tools", P. Narayana Reddy and G. V. R. K. Acharyulu, Excel Books, New Delhi, 1st Edition.
2. "Business Research Methods", Donald R. Cooper & Pamela S Schindler, 9th Edition.
3. "Fundamentals of Statistics", S C Gupta, Himalaya Publications, 7th Edition

Course Code	MACHINE LEARNING		L	T	P	C
21A050430	(Common to CSE, CSE-AI, AIML)		**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand basic concepts of Machine Learning
- To study different learning algorithms
- To illustrate evaluation of learning algorithms
- To gain knowledge on various machine learning algorithms and apply the same on real time data extracted from confined sources.
- To familiarize the students with Python programming packages pertaining to Machine Learning.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts and paradigms of machine learning. **(K2)**
CO2: Identify machine learning techniques suitable for a given problem **(K2)**
CO3: Apply the classification models on discrete data and analyze the efficiency. **(K3)**
CO4: Apply the regression models on continuous data and analyze the efficiency. **(K3)**
CO5: Apply clustering algorithms over the data with appropriate pre-processing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Introduction to Machine Learning &Preparing to Model: Introduction, What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning.

Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic idea of Machine Learning (L3)
- Prepare a model based on the real time requirement(L4)
- Describe the data pre-processing techniques (L2)

UNIT – II (9 Hrs)

Modelling and Evaluation &Basics of Feature Engineering: Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model.

Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection

Learning Outcomes: At the end of this unit, students should be able to

- Select a best model for solving the real time problem (L2)
- Evaluate the performance of a model (L6)

UNIT – III (9 Hrs)

Bayesian Concept Learning: Classification - Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network.

Supervised Learning: Classification - Introduction**,** Example of Supervised Learning**,** Classification Model**,** Classification Learning Steps**,** Common Classification Algorithms-*k*-Nearest Neighbour (*k*NN), Decision tree, Random forest model, Support vector machines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic terminology of supervised learning (L3)
- Apply classification model for solving the problem (L3)
- Apply Bayesian belief network for solving the real time application (L3)

UNIT – IV (9 Hrs)

Supervised Learning: Regression - Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the difference between simple, multiple and polynomial regression (L3)
- Facilitate efficient utilization polynomial regression (L6)
- Apply regression algorithms for solving the real time application(L3)

UNIT – V (9 Hrs)

Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods,

K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods- DBSCAN Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules

Learning Outcomes*:* At the end of this unit, students should be able to

- Describe the different types of clustering techniques (L2)
- Find the pattern using association rule (L3)
- Apply clustering algorithms for solving the real time application (L3)

TEXTBOOKS:

1. "Machine Learning", SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.
2. "Machine Learning", Tom Mitchell, McGraw Hill, 1997.

REFERENCE BOOKS:

1. "Introduction to Machine Learning", Ethern Alpaydin, MIT Press, 2004.
2. "Machine Learning -An Algorithmic Perspective", Stephen Marsland, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2nd Edition,2014.
3. "Introduction to Machine Learning with Python: A Guide for Data Scientists", Andreas C. Müller and Sarah Guido, Oreilly.

ONLINE LEARNING RESOURCES:

1. https://www.deeplearning.ai/machine-learning-yearning/
2. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

Course Code	BIG DATA ANALYTICS USING HADOOP		L	T	P	C
21A050431	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VII			

COURSE OBJECTIVES:

- To familiarize with the installation of Hadoop and how to analyze the Big Data
- To understand the design concepts of HDFS
- To provide good insight for developing a MapReduce applications
- To understand Hadoop environment.
- To explore the concepts of Pig, Hive, Spark and HBase

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic concepts and importance of Big Data **(K2)**
CO2: Develop applications by installing and working with VMWare and Hadoop environment **(K4)**
CO3: Design MapReduce application with various input and output formats **(K4)**
CO4: Demonstrate cluster and Hive environment **(K3)**
CO5: Implement Pig, Spark and HBase applications **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	2	-
CO2	2	3	2	2	1	-	-	-	-	-	-	-	2	-
CO3	2	3	3	2	2	-	-	-	-	-	-	-	1	2
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction to Big Data: What is Big Data? Why Big Data is Important? Meet Hadoop, Data, Data Storage and Analysis, Comparison with other systems, History of Apache Hadoop, Hadoop Ecosystem, VMWare Installation of Hadoop. Analyzing the Data with Hadoop, Scaling Out.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the characteristics of datasets. (L3)
- Compare trivial data and big data for various applications. (L4)
- Choose and implement various ways of selecting suitable model parameters. (L1)

UNIT – II (9 Hrs)

HDFS: The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop File systems, The Java Interface, Data flow.

MapReduce: Developing a MapReduce application, The Configuration API, setting up the Development Environment, Running Locally on Test Data, Running on a Cluster

Learning Outcomes: At the end of this unit, students should be able to

- Understand and apply scaling up Hadoop techniques and associated technologies (L2)
- Estimate suitable test data. (L5)
- Apply the MapReduce application on a cluster. (L3)

UNIT – III (9 Hrs)

How MapReduce Works: Anatomy of a MapReduce, Job Run, Failures, Shuffle and Sort, Task Execution.

MapReduce Types and Formats: MapReduce Types, Input formats, output formats.

Learning Outcomes: At the end of this unit, students should be able to

- Explore the Anatomy of MapReduce. (L5)
- Illustrate various input and output formats of MapReduce. (L2)
- List various MapReduce types. (L1)

UNIT – IV (9 Hrs)

Hadoop Environment: Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration, Security.

Pig: Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User Defined Functions, Data Processing Operators.

Learning Outcomes: At the end of this unit, Student should be able to

- Show the cluster setup and installation. (L2)
- Demonstrate the Configure the Hadoop. (L2)
- Compare Hadoop with various Databases. (L5)

UNIT – V (8 Hrs)

Hive: Installing Hive, Running Hive, Comparison with traditional Databases, HiveQL, Tables, Querying Data.

Spark: Installing Spark, Resilient Distributed Datasets, Shared Variables, Anatomy of a Spark Job Run.

HBase: HBasics, Installation, clients, Building an Online Query Application.

Learning Outcomes: At the end of this unit, students should be able to

- Explain various frameworks of Big Data. (L2)
- Compare Hive with traditional Databases. (L4)
- Learn how to build an online query application. (L1)

TEXTBOOKS:

1. "Hadoop: The Definitive Guide", Tom White, 4th Edition, O'reilly Media, 2015

2. "Big Data, Big Analytics: Emerging business intelligence and analytic trends for today's businesses", Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, Wiley Cio Series

REFERENCE BOOKS:

1. "Making Sense of Data", Glenn J. Myatt, John Wiley & Sons, 2007
2. "Big Data Glossary", Pete Warden, O'Reilly, 2011.
3. "Intelligent Data Analysis", Michael Berthold, David J.Hand, Spingers, 2007.
4. "Understanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data", Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, McGraw Hill Publishing, 2012.
5. "Mining of Massive Datasets", Anand Rajaraman and Jeffrey David UIlman, Cambridge University Press, 2012.

Course Code	DEEP LEARNING (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050432			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To demonstrate the major technology trends driving Deep Learning
- To build, train, and apply fully connected deep neural networks
- To implement efficient (vectorized) neural networks
- To analyse the key parameters and hyper parameters in a neural network's architecture

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the mathematical foundation of neural network. **(K2)**
CO2: Describe the machine learning basics **(K4)**
CO3: Differentiate architecture of deep neural network **(K3)**
CO4: Build a Convolution Neural Network **(K4)**
CO5: Build and train RNN and LSTMs **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms,Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' ule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the tensors, SVD (L3)
- Differentiation between SVD and PCA (L3)
- Understand the different types of pdfs (L4)
- Implementation of Optimization(L2)

UNIT – II (9 Hrs)

Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the validation sets, maximum likely hood (L3)
- Differentiation between Supervised and Unsupervised Learning (L3)
- Implementation of MLP and Solution to XOR problem (L2)

<u>UNIT – III</u> (9 Hrs)

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Constrained Optimization (L3)
- Optimization for Training deep models (L4)
- Implement of Meta Algorithms(L2)

<u>UNIT – IV</u> (9 Hrs)

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the CNN algorithm and its applications in Image Processing (L3)
- Defining the structured outputs (L2)
- Implementation of CNN(L2)

<u>UNIT – V</u> (8 Hrs)

Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the RNN structures (L3)
- Differentiation between LSTM, Gated RNN (L3)
- Implement Deep Generative Models(L2)

TEXTBOOKS:

1. “Deep Learning”, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2016.
2. “Deep learning: A practitioner's approach”, Josh Patterson and Adam Gibson, O'Reilly Media, First Edition, 2017.

REFERENCE BOOKS:

1. “Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms”, Nikhil Buduma, O’Reilly, Shroff Publishers, 2019.
2. “Deep learning Cook Book, Practical recipes to get started Quickly”, Douwe Osinga, O’Reilly, Shroff Publishers, 2019.

ONLINE LEARNING RESOURCES:

1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf
4. https://www.cse.iitm.ac.in/~miteshk/CS7015.html
5. https://www.deeplearningbook.org
6. https://nptel.ac.in/courses/106105215

Course Code	CYBER SECURITY		L	T	P	C
21A050433	(Common to CSE, CSE-IOT)		3	0	0	3
Pre-requisite	Computer Networks	Semester	VII			

COURSE OBJECTIVES:

- To understand essential building blocks and basic concepts of cyber security
- To explore Web security and Network security
- To explain the measures for securing the networks and cloud
- To understand privacy principles and policies
- To describe the legal issues and ethics in computer security

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection **(K3)**

CO2: Assess the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure **(K4)**

CO3: Identify the nature of secure software development and operating systems **(K3)**

CO4: Demonstrate the role security management in cyber security defense **(K2)**

CO5: Adapt the legal and social issues at play in developing solutions **(K3)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	2-
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Vulnerabilities, threats and. Counter measures for computer security (L2)
- Interpret the design of the malicious code (L2)

UNIT – II (9 Hrs)

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the attacks on browser, Web and email. (L2)
- Explain the security aspects of Operating Systems. (L3)

UNIT – III (9 Hrs)

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management.

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network security threats and attacks. (L3)
- Design the Counter measures to defend the network security attacks. (L4)
- Analyze the security tools and techniques for Cloud computing (L4)

UNIT – IV (8 Hrs)

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster

Learning Outcomes: At the end of this unit, students should be able to

- Interpret the need for Privacy and its impacts of Emerging Technologies. (L2)
- Explain how to handle incidents and deal with Disaster. (L2)

UNIT – V (8 Hrs)

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

Learning Outcomes: At the end of this unit, students should be able to

- Adapt legal issues and ethics in computer security. (L4)
- Elaborate on the Emerging topics. (L4)

TEXTBOOKS:

1. "Security in Computing", Pfleeger, C.P., Prentice Hall, 2010, 5th Edition.

2. "Applied Cryptography", Bruce Schneier, John Wiley & Sons, 2nd Edition,1996

REFERENCE BOOKS:

1. "Information Security: The Complete Reference", Mark Rhodes-Ousley, 2nd Edition.
2. "Information Security Management: Concepts and Practice", McGraw-Hill, 2013.
3. "Roadmap to Information Security for IT and Infosec Managers", Michael E. Whitman, and Herbert J. Mattord, Boston, Course Technology, 2011

Course Code	DEVOPS		L	T	P	C
21A050434			3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VII			

COURSE OBJECTIVES:

- To adapt the software Engineering practices that combine Software Development and IT operations for Quality Software
- To enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain how DevOps will balance the needs throughout the SDLC **(K2)**

CO2: Demonstrate how DevOps improves the collaboration and productivity by automation. **(K2)**

CO3: Adapt DevOps in real time projects. **(K3)**

CO4: Illustrate the continuous integration tools and monitoring tools **(K3)**

CO5: Illustrate the DevOps Key maturity models **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3	3	2	-	-	-	-	-	-	-	2	2
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	2
CO4	2	-	2	2	3	-	-	-	-	-	-	-	-	2
CO5	2	3	3	3	2	-	-	-	-	-	-	-	2	-

UNIT – I (9 Hrs)

Phases of Software Development life cycle. Values and principles of agile software development.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the Phases of Software Development life cycle (L2)
- Appraise the Values and principles of agile software development (L5)

UNIT – II (9 Hrs)

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

Learning Outcomes*:* At the end of this unit, students should be able to

- Explain the Fundamentals of Software development and operations (L2)
- Create the Instance of applications (L6)

<u>UNIT – III</u> (9 Hrs)

DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand the Technology aspects and Agile capabilities (L2)
- Interpret the aspects in user’s context (L5)

<u>UNIT – IV</u> (9 Hrs)

CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices

Learning Outcomes*:* At the end of this unit, students should be able to

- Explain CI/CD and its benefits (L2)
- Demonstrate the Continuous Integration, Delivery and Deployment (L2)

<u>UNIT – V</u> (9 Hrs)

DevOps Maturity Model: Key factors of DevOps maturity model, stages of DevOps maturity model, DevOps maturity Assessment

Learning Outcomes*:* At the end of this unit, students should be able to

- Identify the Key factors of maturity model (L3)
- Estimate the DevOps maturity Assessment (L6)

<u>TEXTBOOKS:</u>

1. “The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations”, Gene Kim , John Willis , Patrick Debois , Jez Humb, 1^{st} Edition, O’Reilly publications, 2016.
2. “What is DevOps? Infrastructure as code”, Mike Loukides, O’Reilly publications, 1^{st} Edition, 2012.

<u>REFERENCE BOOKS:</u>

1. “Building a DevOps Culture”, Mandi Walls, O’Reilly publications, 1^{st} Edition, 2013.
2. “The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline With Containerized Microservices”, Viktor Farcic, CreateSpace Independent Publishing Platform publications, 1^{st} Edition, 2016
3. “Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation”, Jez Humble and David Farley, 1^{st} Edition, 2010.
4. “Achieving DevOps: A Novel About Delivering the Best of Agile, DevOps, and microservices”, Dave Harrison, Knox Lively, Apress publications, 1^{st} Edition, 2019

Course Code	DESIGN PATTERNS		L	T	P	C
21A050435	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VII			

COURSE OBJECTIVES:

- To understand design patterns and their underlying objects oriented concepts.
- To learn the day-to-day problems faced by object-oriented designers and how design patterns solve them
- To provide an interface for creating families of related objects without specifying their concrete classes.
- To know the consequences of combining patterns on the overall quality of a system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solving various Problems Using Design Patterns. **(K3)**
CO2: Applying various patterns to problems in designing lexi. **(K3)**
CO3: Comparing various structural patterns. **(K4)**
CO4: Applying Behavioral Patterns to various design issues. **(K3)**
CO5: Analysing and comparing various Patterns. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	2
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	3	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	3	-

UNIT – I (9 Hrs)

Introduction to Design Patterns: Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing the Catalog, Solving of Design Problems using Design Patterns, Selection of a Design Pattern, Use of Design Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Develop design patterns in Small Talk MVC (L6).
- How to select and use a Design Pattern (L1).
- Solve problems using design patterns (L3).

UNIT – II (9 Hrs)

Designing A Document Editor: Design problems, Document structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel standards, Supporting

Multiple Window Systems, User Operations, Spelling Checking and Hyphenation. Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Apply eight different patterns to Document editor's design. (L3).
- Specify the kinds of objects to create new objects using prototype(L4).

UNIT - III (9 Hrs)

Structural Patterns: Structural Patterns-1: Adapter, Bridge, Composite. Structural Patterns-2: Decorator, Facade, Flyweight, Proxy, Discuss of Structural Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Understand structural patterns (L2).
- Explain adapter, bridge and composite structural patterns (L2).
- Create decorator, facade, flyweight and proxy structural patterns (L6)

UNIT – IV (9 Hrs)

Behavioural Patterns: Behavioural Patterns-1: Chain of Responsibility, Command, Interpreter, Iterator. Behavioural Patterns-2: Mediator, Memento, Observer.

Learning Outcomes: At the end of this unit, students should be able to

- Define behavioural patterns (L1).
- Demonstrate object scope behavioural patterns (L2).
- Justify description for different types of behavioural patterns (L5).

UNIT – V (8 Hrs)

Behavioural Patterns and History: Behavioural Patterns-2(cont'd): State, Strategy, Template Method, Visitor, and Discussion of Behavioural Patterns. What to Expect from Design Patterns, a Brief History. The Pattern Community, An Invitation, A Parting Thought

Learning Outcomes: At the end of this unit, students should be able to

- Identify behavioural patterns (L6).
- Justify different types of behavioural patterns (L5).
- Determine community for patterns (L4).

TEXTBOOKS:

1. "Design Patterns", Erich Gamma, Pearson Education.

REFERENCE BOOKS:

1. "Patterns in JAVA", Vol-I , Mark Grand, Wiley DreamTech.
2. "Patterns in JAVA", Vol-II, Mark Grand, Wiley DreamTech.
3. "JAVA Enterprise Design Patterns", Vol-III, Mark Grand, Wiley DreamTech.

4. “Pattern Oriented Software Architecture”, Buschmann & others, John Wiley & Sons.

ONLINE LEARNING RESOURCES:

1. https://refactoring.guru/design-patterns
2. https://www.geeksforgeeks.org/software-design-patterns/
3. https://en.wikipedia.org/wiki/Software_design_pattern

Course Code	BLOCK CHAIN TECHNOLOGY		L	T	P	C
21A050436	(Common to CSE, CSE-AI, AIML)		3	0	0	3
Pre-requisite	Computer Networks	Semester	VII			

COURSE OBJECTIVES:

- To understand how block chain systems (mainly Bitcoin and Ethereum) work and to securely interact with them.
- To design, build, and deploy smart contracts and distributed applications
- To integrate ideas from block chain technology into their own projects

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding. **(K2)**

CO2: Identify the risks involved in building Block chain applications. **(K2)**

CO3: Review of legal implications using smart contracts. **(K2)**

CO4: Choose the present landscape of Block chain implementations and Understand Crypto currency markets. **(K3)**

CO5: Examine how to profit from trading crypto currencies **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		3	-	-	-	-	-	-	-	-	2
CO2	3	-	-	3	-	-	-	3	-	-	-	-	-	2
CO3	3	3	2	-	-	-	-	-	-	3	-	-	3	-
CO4	3	3	2		3	-	-	-	-	-	-	-	2	-
CO5	3	3	-	3	-	3	-	3	-	-	-	-	3	2

UNIT – I (10 Hrs)

Introduction: Introduction, Scenarios, Challenges Articulated, Block chain, Block chain Characteristics, Opportunities Using Block chain, History of Block chain. Evolution of Block chain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Block chain Evolution, Consortia, Forks, Public Block chain Environments, Type of Players in Block chain Ecosystem, Players in Market.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the benefits and challenges of Block chain (L2)
- Design the Blockchain applications (L6)

UNIT – II (9 Hrs)

Block chain Concepts: Block chain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on block chain, data storage on block chain, wallets, coding on block chain: smart contracts, peer-to-peer network, types of block chain nodes, risk associated with block chain solutions, life cycle of block chain transaction.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate Blockchain concepts (L2)
- Work with Blockchain technology (L6)

<u>UNIT – III</u> (9 Hrs)

Architecting Block chain solutions: Architecting Block chain solutions: Introduction, Obstacles for Use of Block chain, Block chain Relevance Evaluation Framework, Block chain Solutions Reference Architecture, Types of Block chain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Block chain Solutions, Architecture Considerations, Architecture with Block chain Platforms, Approach for Designing Block chain Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Make Blockchain solutions (L3)
- Distinguish types of Blockchain Applications (L4)

<u>UNIT – IV</u> (8 Hrs)

Ethereum Block chain Implementation: Ethereum Block chain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, Open Zeppelin Contracts

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the use of Ethereum development tools (L2)
- Create Ethereum accounts and work with them (L6)

<u>UNIT – V</u> (9 Hrs)

Hyper ledger Blockchain Implementation: Hyperledger Blockchain Implementation, Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chaincode Functions Using Client Application. Advanced Concepts in Blockchain: Introduction, Inter Planetary File System (IPFS), Zero Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the use of Hyperledger Blockchain Implementation (L2)

- Demonstrate Blockchain Cloud Offerings (L2)

TEXTBOOKS:

1. "Blockchain for Enterprise Application Developers", Ambadas, Arshad Sarfaraz Ariff, Sham Wiley
2. "Mastering Bitcoin: Programming the Open Blockchain", Andreas M. Antonpoulos, O'Reilly

REFERENCE BOOKS:

1. "Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions", Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. "Blockchain: Blueprint for a New Economy", Melanie Swan, O'Reilly

ONLINE LEARNING RESOURCES:

1. https://github.com/blockchainedindia/resources
2. https://www.hyperledger.org/projects/fabric
3. https://nptel.ac.in/courses/106105184
4. https://onlinecourses.nptel.ac.in/noc22_cs44/preview

Course Code	GRAPHICS & MULTIMEDIA SYSTEMS		L	T	P	C
21A050437			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the use of the components of a graphics system and become familiar with the building approach of graphics system components and related algorithms.
- To understand the basic principles of 3- 3-dimensional computer graphics.
- To provide insites on how to scan, convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
- To provide an understanding of mapping from world coordinates to device coordinates, clipping, and projections.
- To discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the basic concepts used in computer graphics. **(K2)**
CO2: Inspect various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping **(K3)**.
CO3: Assess the importance of viewing and projections. **(K4)**.
CO4: Define the fundamentals of animation, virtual reality and its related technologies. **(K3)**.
CO5: Analyze the typical graphics pipeline **(K4)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	2	2
CO3	3	2	3	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	-	-	-	-	-	-	-	-	2	2
CO5	3	2	3	1	-	-	-	-	-	-	-	-	3	3

UNIT – I (10 Hrs)

Overview of Computer Graphics System – Video display devices – Raster Scan and random scan system – Input devices – Hard copy devices.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the overview of computer graphics with visualization. (L2)
- Classify the Input devices. (L2)
- Distinguish raster scan and random scan systems. (L4)

UNIT – II (9 Hrs)

Output Primitives and Attributes: Drawing line, circle and ellipse generating algorithms –

Scan line algorithm – Character Generation – attributes of lines, curves and characters – Antialiasing.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse output primitives and attributes. (L4)
- Design algorithms based on output. (L6)

<u>UNIT – III</u> (9 Hrs)

Two-dimensional Geometric Transformations – Windowing and Clipping – Clipping of lines andclipping of polygons.

Learning Outcomes: At the end of this unit, students should be able to

- Create two-dimensional graphics. (L6)
- Examine the clipping of polygon. (L4)
- Compare different forms of variations. (L2)

<u>UNIT – IV</u> (9 Hrs)

Three-dimensional concepts – Object representations- Polygon table, Quadric surfaces, Splines, Bezier curves and surfaces – Geometric and Modeling transformations – Viewing - Parallel and perspective projections.

Learning Outcomes: At the end of this unit, students should be able to

- Create three-dimensional graphics. (L6)
- Explain the Quadric surfaces and polygon table. (L2)
- Define modelling transformations. (L1)

<u>UNIT – V</u> (8 Hrs)

Removal of Hidden Surfaces: Visible Surface Detection Methods – Computer Animation.

Learning Outcomes: At the end of this unit, students should be able to

- List the different types of detection methods. (L1)
- Compare various computer animations. (L2)

<u>TEXTBOOKS:</u>

1. "Computer Graphics (C-Version)", Hearn, D. and Pauline Baker, M., 2nd Edition, Pearson Education, 2002

<u>REFERENCE BOOKS:</u>

1. "Principles of Interactive Computer Graphics", Neuman, W.M., and Sproull, R.F., Mc Graw Hill Book Co., 1979.
2. "Procedural elements for Computer Graphics", Roger, D.F., Mc Graw Hill Book Co., 1985.
3. "Computer Graphics", Asthana, R.G.S and Sinha, N.K., New Age Int. Pub. (P) Ltd., 1996.

4. "Computer Graphics", Floey, J.D., Van Dam, A, Feiner, S.K. and Hughes, J.F, Pearson Education, 2001.

Course Code	STORAGE AREA NETWORKS		L	T	P	C
21A050438			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To evaluate storage architectures
- To define backup, recovery, disaster recovery, business continuity, and replication
- To examine emerging technologies including IP-SAN
- To understand logical and physical components of a storage infrastructure
- To identify components of managing and monitoring the data center
- TO define information security and identify different storage virtualization technologies

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify key challenges in managing information and analyze different storage networking technologies and virtualization. **(K2)**

CO2: Explain components and the implementation of NAS. **(K3)**

CO3: Describe CAS architecture and types of archives and forms of virtualization **(K3)**

CO4: Illustrate the storage infrastructure and management activities **(K4)**

CO5: Exhibit knowledge in the role of Remote Replication Technologies, Security Implementations in Storage Networking**. (K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	2	1	2	1	1	-	-	-	-	-	-	-	1	-
CO4	2	-	2	-	2	-	-	-	-	-	-	-	-	2
CO5	3	-	-	-	2	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Storage System: Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application

Learning Outcomes: At the end of this unit, students should be able to

- Understand Storage Area Networks characteristics and components (L3)
- Describe the challenges associated with data center networking and the need for switch network convergence (L3)

- Storage Area Networks including storage architectures, logical and physical components of a storage infrastructure, managing and monitoring the data center (L4)

UNIT – II (9 Hrs)

Data Protection - RAID : RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison. Intelligent Storage Systems : Components of an Intelligent Storage System, Types of Intelligent Storage Systems. Fibre Channel Storage Area Networks - Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN.

Learning Outcomes*:* At the end of this unit, students should be able to

- Describe the concept of RAID and different RAID levels and their suitability for different application environments. (L3)
- Learn Fibre Channel protocols and how SAN components use them to communicate with each other. (L3)
- Describe files sharing operations on NAS and IP-SAN of the different network (L3)

UNIT – III (9 Hrs)

IP SAN and FCoE: iSCSI, FCIP, Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand the different networked storage options for different application environments (L2)
- Describe the business continuity and disaster recovery in a storage infrastructure (L3)
- Understand the different File-Sharing Protocols (L3)

UNIT – IV (9 Hrs)

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions, Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments.

Learning Outcomes*:* At the end of this unit, students should be able to

- Describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities (L6)
- Identify key areas to monitor in a data center for different components in a storage infrastructure. (L5)

UNIT – V (9 Hrs)

Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency , Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas. Remote Replication: Modes of Remote Replication, Remote Replication Technologies. Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains. Security Implementations in Storage Networking

Learning Outcomes: At the end of this unit, students should be able to

- Describe different type process and file-level virtualization technologies (L2)
- Understand the Remote Replication Technologies (L3)
- Understand the Security Implementations in Storage Networking. (L3)

TEXTBOOKS:

1. "Information Storage and Management", EMC Education Services, Wiley India Publications, 2009.

REFERENCE BOOKS:

1. "Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs Paperback", Paul Massiglia, Richard Barker, Wiley India Publications, 1st Edition, 2008

Course Code	MANAGEMENT SCIENCE (Common to all Branches)		L	T	P	C
21A110204			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concepts and principles of management in real life industry design and develop organization chart and structure for an enterprise. **(K3)**

CO2: Apply operations management techniques in real life industry. **(K3)**

CO3: Apply the concepts of HRM in Recruitment, Selection, Training & Development. **(K3)**

CO4: Develop PERT/CPM charts for projects of an enterprise and estimate time & cost of a project and to develop Mission, Objectives, Goals & Strategies for an enterprise in dynamic environment. **(K3)**

CO5: Understand & apply modern management techniques wherever possible. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	3	-	-	-

UNIT – I (9 Hrs)

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of management and organization (L2)
- Apply the concepts & principles of management in real life industry (L3)
- Analyze the organization chart & structure for an enterprise.(L4)
- Evaluate and interpret the theories and the modern organization theory (L5)

UNIT – II (10 Hrs)

Operations Management: Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management** - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the core concepts of Management Science and Operations Management (L2)
- Apply the knowledge of Quality Control, Work-study principles in real life industry (L3)
- Evaluate Materials departments & Determine EOQ (L5)
- Analyze Marketing Mix Strategies for an enterprise (L4)
- Create and design advertising and sales promotion (L5)

UNIT – III (6 Hrs)

HUMAN RESOURCES MANAGEMENT: HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development (L2)
- Apply Managerial and Operative Functions (L3)
- Analyze the need of training (L4)
- Evaluate performance appraisal (L5)
- Design the basic structure of salaries and wages (L5)

UNIT – IV (12 Hrs)

Strategic & Project Management: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and

Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

Learning Outcomes: At the end of this unit, students should be able to

- Understand Mission, Objectives, Goals & Strategies for an enterprise (L2)
- Apply SWOT Analysis to strengthen the project (L3)
- Analyze Strategy formulation and implementation (L4)
- Evaluate PERT and CPM Techniques (L5)
- Create in competing the projects within given time (L5)

<u>UNIT – V</u> (8 Hrs)

Contemporary Issues in Management: The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand modern management techniques (L2)
- Apply Knowledge in modern management (L3)
- Analyze CRM, TQM (L4)
- Evaluate Six Sigma concept and SCM (L5)

<u>TEXTBOOKS:</u>

1. “Management Science”, A.R Aryasri, TMH, 2013
2. “Management”, Stoner, Freeman, Gilbert, Pearson Education, New Delhi, 2012.

<u>REFERENCE BOOKS:</u>

1. “Essentials of Management”, Koontz &Weihrich, TMH, 6th Edition, 2005.
2. “Management Principles and Guidelines”, Thomas N. Duening & John M. Ivancevich, Biztantra.
3. “Production and Operations Management”, Kanishka Bedi, Oxford University Press, 2004.
4. “Modern Management”, Samuel C. Certo, 9th Edition, PHI, 2005

Course Code	**HACKING TOOLS**		**L**	**T**	**P**	**C**
21A050706	(Common to CSE, CSE-AI, CSE-IOT, AIML)		**1**	**0**	**2**	**2**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the effects of Hacking
- To protect themselves from hacking
- To identify various types of Hacking Tools

.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various Hacking Threats.**(K4)**
CO2: Perform various Hacking Methods.**(K3)**
CO3: Evaluate the various types of Hacking Techniques **(K4)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	2

LIST OF EXPERIMENTS:

Week 1

Network Security and Threats, Cyber Ethics Hacking Introduction

Week 2

Scanners :- What is scanning? How to perform Scanning on a demo-website.

Week 3

Viruses and worms and Trojans. Virus Analysis

Week 4

Snooping:- Email, DNS and IP

Week 5

Honey Pots: Creation and Execution

Week 6

Information Gathering , Session Hijacking

Week 7

Hacking Wireless Networks

Week 8 & 9

SQL injections and Hacking Mobiles

Week 10 & 11

Social Engineering and safety requirements

TEXTBOOKS:

1. "Hack-x-crypt: a straight forward guide towards ethical hacking and cyber-Security", Udval sahay

REFERENCE BOOKS:

1. "ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking", Hein Smith

ONLINE LEARNING RESOURCES:

1. https://www.synopsys.com/glossary/what-is-ethical-hacking.html#:~:text=Definition,and%20actions%20of%20malicious%20attackers.
2. https://intellipaat.com/blog/what-is-ethical-hacking/

OPEN ELECTIVE – I

Course Code	AIR POLLUTION AND CONTROL		L	T	P	C
21A010501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To identify the sources of air pollution
- To know the composition and structure of atmosphere
- To know the pollutants dispersion models
- To understand the working of air pollution control equipment
- To identify the sources of noise pollution and their controlling methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the sources of air pollution. **(K2)**
CO2: Explain the composition and structure of atmosphere. **(K4)**
CO3: Discuss the general characteristics of stack emissions and their behavior. **(K2)**
CO4: Understand the mechanism of Control of air pollutants. **(K2)**
CO5: Know about the noise sources, mapping, prediction equations etc. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	-	-	-	3	1	-	-	-	-	3	1
CO2	3	1	3	-	-	-	3	1	-	-	-	-	1	1
CO3	3	2	2	-	-	-	3	1	-	-	-	-	2	2
CO4	3	1	2	-	-	-	3	1	-	-	-	-	1	1
CO5	3	2	2	-	-	-	3	1	-	-	-	-	1	2

UNIT – I (9 Hrs)

Introduction: sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance. Indoor Air Pollution– sources, effects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the character of atmospheric pollutants and their effect. (L4)

UNIT – II (9 Hrs)

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Wind rose diagram.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the composition and structure of atmosphere. (L4)
- Write the maximum mixing depth and windrose diagram. (L6)

UNIT – III (9 Hrs)

General characteristics of stack emissions, plume behavior, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources. Monitoring of particulate matter and gaseous pollutants –respirable, non-respirable and nano - particulate matter. CO, CO2, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

Learning Outcomes: At the end of this unit, students should be able to

- Express about the general characteristics of stack emissions and their behavior. (L6)
- Analyze the monitoring of particulate matter and gaseous pollutants. (L4)

UNIT – IV (9 Hrs)

Air Pollution Control equipment for particulate matter & gaseous pollutants– gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – Adsorption, Absorption, Scrubbers, Condensation and Combustion.

Learning Outcomes: At the end of this unit, student should be able to

- Explain the various air pollution control equipment. (L3)

UNIT – V (9 Hrs)

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the noise sources, mapping, prediction equations etc., (L5)

TEXTBOOKS:

1. “Air Pollution - Its Origin and Control”, Wark K., Warner C.F., and Davis W.T, Harper & Row Publishers, New York.
2. “Environmental Engineering”, H.S. Peavy, D.R. Row & G. Tchobanoglous, Mc Graw Hill International Edition

REFERENCE BOOKS:

1. “Air Pollution”, Perkins H.C., McGraw Hill.
2. “Air Pollution Control Theory”, Crawford M., TATA McGraw Hill.
3. “Air Pollution”, Stern A.C., Volume I, II, III.
4. “Air Pollution”, Seinfeld N.J., McGraw Hill.
5. “Air Quality Management”, Stern A.C., Volume V.
6. “Air Pollution”, M N Rao and HVN Rao, Tata McGraw Hill publication

ONLINE LEARNING RESOURCES:

1. http://www.epa.gov
2. http://www.indiaenvironmentportal.org.in
3. http://nptel.iitm.ac.in
4. http://www.filtersource.com

Course Code	ELECTRIC VEHICLES		L	T	P	C
21A020501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- Get exposed to EV system configuration and parameters
- Know about electro mobility and environmental issues of EVs
- Understand about basic EV propulsion and dynamics
- Understand about fuel cell technologies for EV and HEVs
- Know about basic battery charging and control strategies used in electric vehicles

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand and differentiate between conventional and latest trends in Electric vehicles. **(K2)**

CO2: Analyze various EV resources, EV dynamics and Battery charging. **(K4)**

CO3: Apply basic concepts of EV to design complete EV system. **(K3)**

CO4: Design EV system with various fundamental concepts. **(K5)**

CO5: Analyze the various control strategies used in battery charging in the electric vehicles. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to EV Systems and Parameters: Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic concepts of EV to design complete EV system. (L3)
- Explain EV system configuration. (L3)
- Understand various EV parameters. (L2)

UNIT – II (9 Hrs)

EV and Energy Sources: Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand electro mobility and environmental issues of EVs. (L2)
- Explain the history of Electric power trains. (L3)
- Compare conventional, battery, hybrid and fuel cell electric systems. (L3)

UNIT – III (9 Hrs)

EV Propulsion and Dynamics: Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi-motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of EV system. (L2)
- Choose a suitable electric propulsion system. (L2)
- Classify EV motors and their applications. (L3)

UNIT – IV (9 Hrs)

Fuel Cells: Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples.

Learning Outcomes: At the end of this unit, students should be able to

- FUEL CELLS: Explain the working principle of Fuel cells. (L3)
- Analyze fuel cell technologies for EV and HEVs. (L4)
- Compare series, series-parallel hybrid systems. (L3)

UNIT – V (9 Hrs)

Battery Charging and Control: Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modeling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic battery charging in Electric Vehicles. (L2)
- Analyze control strategies used in electric vehicles. (L4)

TEXTBOOKS:

1. "Modern Electric Vehicle Technology", C.C Chan, K.T Chau, Oxford University Press Inc., New York 2001.
2. "Electric Vehicle Technology Explained", James Larmenier, John Lowry, Wiley, 2003.

REFERENCE BOOKS:

1. "Electric and Hybrid Vehicles Design Fundamentals", Iqbal Husain, CRC Press 2005.
2. "Advanced Electric Drive Vehicles", Ali Emadi, CRC Press, 2015.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

Course Code	ELECTRICAL DISTRIBUTION SYSTEMS		L	T	P	C
21A020502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- The classification of distribution systems
- The aspects and design considerations in DC and AC distribution and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the various factors associated with power distribution. **(K3)**
CO2: Make voltage drop calculations in given distribution networks. **(K3)**
CO3: Learn principles of substation maintenance. **(K2)**
CO4: Compute power factor improvement for a given system and load. **(K3)**
CO5: Understand implementation of SCADA for distribution automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Load Modeling and Characteristics: Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural, and Industrial) and Their Characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of the electrical distribution systems. (L2)
- Analyze the relationship between load factor and loss factor. (L4)
- Understand the various loads and its characteristics. (L2)

UNIT – II (9 Hrs)

Classification Of Distribution Systems: Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and

Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the classification of electrical distribution systems. (L2)
- Analyze the design considerations of the radial and loop type feeders. (L4)

<u>UNIT – III</u> (9 Hrs)

Substations: Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar Sectionalized Single Bus Bar, With Relevant Diagrams.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the layout of the substation and various equipment installed. (L2)
- Analyze the classification of the substation based on insulating medium. (L4)
- Understand various bus bar schemes in substation. (L2)

<u>UNIT – IV</u> (9 Hrs)

Power Factor Improvement: Three Phase Balanced Primary Lines. Causes of Low P.F - Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

<u>UNIT – V</u> (9 Hrs)

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

TEXTBOOKS:

1. "Electric Power Distribution Engineering", Turan Gonen, CRC Press, 3rd Edition, 2014.
2. "Electric Power Distribution", A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

REFERENCE BOOKS:

1. "Electric Power Distribution Automation", Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010
2. "Electrical Power Distribution Systems", V. Kamaraju, Jain Book Depot, 2012.

<table>
<tr><td>Course Code</td><td rowspan="2">ROBOTICS</td><td colspan="2"></td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A030501</td><td colspan="2"></td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td colspan="2">Semester</td><td colspan="4">V</td></tr>
</table>

COURSE OBJECTIVES:

- To familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control
- To choose and incorporate robotic technology in engineering systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the introduction and types of robots. **(K2)**

CO2: Analyze kinematics using forward and inverse kinematics and dynamics of robots using transformation, Jacobians, Lagrange – Euler and Newton – Euler formation. **(K4)**

CO3: Understand the working principle of different types of actuators and sensors. **(K2)**

CO4: Understand the motion types and robot programming software. **(K2)**

CO5: Know importance of robotic Applications in manufacturing. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	1	-	-	-	-	-	-	2	3	-
CO2	1	-	3	-	-	-	-	-	-	-	-	1	1	3
CO3	3	-	2	-	2	-	-	-	-	-	-	1	3	1
CO4	3	-	2	-	3	-	-	-	-	2	-	-	3	2
CO5	3	-	2	-	2	-	-	-	-	1	-	2	3	-

UNIT – I (8 Hrs)

Introduction to Industrial Robots: Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of robots. (L2)
- Differentiate types of robots and robot grippers. (L4)

UNIT – II (8 Hrs)

Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation-D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformation, Jacobians .Lagrange – Euler and Newton – Euler formations.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire the knowledge about robot kinematics and dynamics. (L2)

- Analyze the forward and inverse kinematics of robot manipulators. (L4)

UNIT – III (9 Hrs)
Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile sensors, Proximity sensors.
Learning Outcomes: At the end of this unit, students should be able to

- Identify the various types of robot actuators and feedback components. (L1)
- Understand the working of robot sensors. (L2)

UNIT – IV (11 Hrs)
Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion.
Robot programming - Types – features of languages and software packages.
Learning Outcomes: At the end of this unit, students should be able to

- Analyze motion in links and joints of a robot. (L4)
- Understand the types and software packages of robots. (L2)

UNIT – V (9 Hrs)
Robot Application in Manufacturing: Material Transfer -Material handling, loading and unloading - Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.
Learning Outcomes: At the end of this unit, students should be able to

- Express the various applications of robots in industries. (L2)
- Acquire the knowledge about real time applications of robots in manufacturing. (L2)

TEXTBOOKS:

1. "Industrial Robotics", M.P. Groover, TMH.
2. "Robotics, Fundamental Concepts and analysis", Ashitave Ghosal, Oxford Press
3. "Robotics and Control", Mittal R K & Nagrath I J, TMH.

REFERENCE BOOKS:

1. "Robotics", Fu K S, McGraw Hill.
2. "An Introduction to Robot Technology", P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. "Robotic Engineering", Richard D. Klafter, Prentice Hall
4. "Introduction to Robotics", John J. Craig, Pearson Edu
5. "Automation, Production systems and CIM", M.P. Groover, Pearson Edu

Course Code	BASICS OF MECHANICAL ENGINEERING		L	T	P	C
21A030502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize students with basic power plants types, turbines, pumps, IC engines, boilers, refrigeration and air conditioning process and their performance aspects.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know types of power generating plants by using conventional or Non-conventional resources. **(K2)**

CO2: Understand and implementation of turbines, explain different types of pumps and their application. **(K2)**

CO3: Describe To familiarize the developments in IC engines. **(K2)**

CO4: Uunderstand the concept of the boilers. **(K2)**

CO5: Explain the working principles of refrigeration and air conditioning systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	2	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-	-	2	-	-

UNIT – I (10 Hrs)

Power Plant Engineering: Introduction – Energy Renewable and Non – Renewable Energy, Sources – Classification of Power Plants based on Sources of Energy – Thermal Power Plant or Steam Power Plant – Hydro Electric Power – Nuclear Fission, Chain Reaction, Layout of Nuclear Power Plant – Diesel Power Plant – Gas Turbine Power Plant – Open Cycle Gas Turbine, Closed Cycle Gas Turbine Power Plant, Comparison of Diesel Power Plant with Gas Turbine Power Plant.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the energy Renewable and Non – Renewable Energy Sources. (L2)
- Illustrate the working principle of Steam, Nuclear & open cycle, and closed cycle gas turbine. (L2)

UNIT – II (10 Hrs)

Hydraulic Turbine – Classification of Hydraulic Turbines, Impulse Turbine, Reaction Turbine, Difference between Impulse and Reaction Turbine.

Pumps – Classification of Pumps, Centrifugal Pump, Applications of Centrifugal Pump, Priming, Reciprocating Pumps, Single Acting Reciprocating Pump, Working of a Double acting Reciprocating Pump, Comparison of Reciprocating Pump with Centrifugal Pump.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Hydraulic Turbines, Impulse Turbine, and Reaction Turbine. (L2)
- Understand the working of Centrifugal Pump, Reciprocating Pumps and Comparison between them. (L2)

UNIT – III (10 Hrs)

I.C Engine: Heat Engine – Types of Heat Engine – External Combustion Engine, IC Engine (Internal Combustion), Classification of I.C. Engine, Two Stroke Petrol Engine, Four Stroke Engine, Valve Timing Diagram, Port Timing Diagram, Comparison of Two Stroke and Four Stroke Engines, Comparison of Petrol Engine and Diesel Engine, Fuel System of a Petrol Engine, Ignition Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of External Combustion Engine, IC Engine. (L2)
- Illustrate the working of Two Stroke Petrol Engine, Four Stroke Engine. (L2)

UNIT – IV (7 Hrs)

Boilers: Classification of Boilers – Simple Vertical Boiler – Cochran Boiler – Babcock and Wilcox Boiler – Benson Boiler – Difference between Fire Tube and Water Tube Boilers – Boiler Mountings – Boiler Accessories – Difference between Boiler Mountings and Accessories.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of different types Fire Tube and Water Tube Boilers.(L2)

UNIT – V (8 Hrs)

Refrigeration and Air Conditioning: Introduction – Terminology of Refrigeration and Air Conditioning – Properties of Refrigerants – List of Commonly used Refrigerants – Types of Refrigerating System – Vapour Compression Refrigeration System – Vapour Absorption Refrigerator – Domestic Refrigerator – Air Conditioning – Application of Air Conditioning –Psychrometry – Window Air Conditioning.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Vapour Compression Refrigeration System – Vapour Absorption Refrigeration system. (L2)
- Illustrate the working of Air Conditioning. (L2)

TEXTBOOKS:

1. "Basic Civil and Mechanical Engineering", Er. R. Vaishnavi, Prof. V. Vijayan, Prof. M. Prabhakaran, S. Chand Publication, 2nd Edition
2. "Elements of Mechanical Engineering", S Trymbaka Murthy, University Press, 4th Edition

REFERENCE BOOKS:

1. "Elements of Mechanical Engineering", S. N. Lal, Cengage Learning, 2013
2. "Elements of Mechanical Engineering", S. Trymbaka Murthy, Universities Press, 2015
3. "Mechanical Technology", Dr M. Maruthi Rao and V. Pavan Kumar, Lambert Academic Publishing, 2022

Course Code	INTEGRATED CIRCUITS AND APPLICATIONS		L	T	P	C
21A040501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To introduce the basic building blocks of linear integrated circuits.
- To impart knowledge on linear and non-linear applications of Op-Amps.
- To design various circuits using Op-Amps.
- To familiarize with specialized ICs such as 555 timer and voltage regulators.
- To familiarize with digital ICs.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the construction and characteristics of Operational Amplifier IC **(K2)**
CO2: Explain various linear & non-linear applications of Op-amp **(K2)**
CO3: Develop knowledge on filters and describe internal circuit operation of 555 timer and voltage regulators ICs **(K3)**
CO4: Summarize combinational circuits using Digital integrated circuits **(K3)**
CO5: Explain the internal structure of sequential Digital integrated circuits **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	3	1	-
CO2	2	2	2	1	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	1	-	-	-	-	-	-	-	3	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	1	-

UNIT – I (8 Hrs)

INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER: Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of IC & classifications (L2)
- Understand the concepts of Operational amplifier. (L2)
- Illustrate the internal circuit of operational amplifier (L2)
- Analyze DC & AC characteristics of op-amp (L4)

UNIT – II (10 Hrs)

LINEAR APPLICATIONS OF OP-AMP: Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveformgenerators, Oscillators

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of integrator & differentiator circuits (L2)
- Understand the concepts of multivibrators and waveform generators (L2)
- Develop the output voltage expression for instrumentation amplifier (L3)
- Analyze the adder, subtractors, multiplier and divider circuits (L4)

UNIT – III (10 Hrs)

ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

TIMERS AND REGULATORS: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, Introduction-Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on 1st and 2nd order active filters. (L3)
- Understand the functionality of 555 timer. (L2)
- Understand the internal structure and functionality of voltage regulators (L2)

UNIT – IV (8 Hrs)

COMBINATIONAL CIRCUITS USING TTL 74XX ICS: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7- segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on the working of various combinational circuit ICs. (L3)
- Develop higher order combinational circuits from lower order Combinational ICs. (L3)

UNIT – V (9 Hrs)

SEQUENTIAL CIRCUITS USING TTL 74XX ICS: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493), Memory -SRAM & DRAM.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of sequential circuits using TTL ICs. (L2)

- Develop higher order Sequential circuits from lower order Sequential ICs. (L3)

TEXTBOOKS:

1. "Linear Integrated Circuit", D. Roy Choudhury, Shail B. Jain, New Age International Pvt.Ltd., New Delhi, India, 4th Edition, 2012
2. "OP-AMP and Linear Integrated Circuits", Ramakant A. Gayakwad, Prentice Hall / Pearson Education, New Delhi, 4th Edition, 2012
3. "Digital Fundamentals", Floyd, Jain, Pearson Education, New Delhi, 8th Edition, 2009.

REFERENCE BOOKS:

1. "Design with operational amplifiers and analog integrated circuits", Sergio Franco McGrawHill, New Delhi, 1997
2. "Digital Design Principles and Practices", John F Wakerly, Pearson Education, 4th Edition

Course Code	INTRODUCTION TO SIGNAL PROCESSING		L	T	P	C
21A040502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- To represent continuous time signals (both periodic and non-periodic) in the time domain, s-domain and the frequency domain.
- To understand the properties of analog filters, and have the ability to design Butterworth filters.
- To understand and apply sampling theorem and convert a signal from continuous time to discrete time and able to represent the discrete time signal in the frequency domain.
- To understand FIR and IIR filters to meet given specifications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain continuous time and discrete time signals and systems, in time and frequency domain. **(K3)**

CO2: Apply Fourier series and Fourier Transform to analyze periodic & non-periodic signals and their spectra. **(K3)**

CO3: Design and implement the analog filter using components/suitable simulation tools. **(K4)**

CO4: Apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time. **(K3)**

CO5: Design and implement the digital filter using suitable simulation tools. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction to Signals & Systems: Signal Definition, Signal Classification, System definition, System classification for both continuous time and discrete time, Basic Operations on Signals, Elementary Signals & Sequences, Definition of LTI systems, Transfer function of a LTI system, Concepts of Convolution and Correlation of signals, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different basic types of signals and systems. (L2)

- Understand various basic operations on signals and elementary signals. (L2)
- Describe continuous time signal and discrete time signal. (L2)
- Sketch the various types of basic signals for both continuous time & discrete time. (L3)
- Understand the LTI systems, convolution & correlation of signals. (L2)

UNIT – II (10 Hrs)
Fourier Series & Transform: Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems, Fourier Transform of arbitrary signal, Properties of Fourier Transform, Illustrative Problems.
Learning Outcomes: At the end of this unit, students should be able to

- Analyze the periodic signals by applying Fourier series. (L4)
- Apply Fourier transform to solve problems. (L3)
- Analyze the spectral characteristics of signals. (L4)

UNIT – III (8 Hrs)
Analog Filters: Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications, Illustrative Problems.
Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of analog filters. (L2)
- Design and implement the analog Butterworth filters. (L4)

UNIT – IV (8Hrs)
Sampling Theorem & DFT: Sampling Theorem- Statement and proof, converting the analog signal to a digital signal, Practical sampling, The Discrete Fourier Transform, Properties of DFT, IDFT, Comparing the frequency response of analog and digital systems, Illustrative Problems.
Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of sampling techniques. (L2)
- Illustrate signal sampling and its reconstruction. (L3)
- Explain the importance of discrete Fourier transform. (L3)

UNIT – V (10Hrs)
Digital Filters: Characteristics of FIR and IIR filters. Frequency response of ideal digital filters, Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, Comparison of FIR & IIR, Illustrative Problems.
Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of IIR and FIR digital Filters. (L2)
- Analyze windowing techniques in FIR filters. (L4)

- Illustrate the digital filters of different techniques. (L3)
- Design IIR and FIR filters. (L4)

TEXTBOOKS:

1. "Signals, Systems and Communications", B. P. Lathi, BS Publications, 2008.
2. "Digital signal processing, principles, Algorithms and applications", John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 4th Edition, 2007.
3. "Discrete Time Signal Processing", A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

REFERENCE BOOKS:

1. "Linear Systems and Signals", B. P. Lathi, Oxford University press, 2nd Edition.
2. "Digital Signal Processing – Fundamentals and Applications", Li Tan, Elsevier, 2008.
3. "Signals, Systems and Transforms", C. L. Philips, J. M. Parr and Eve A. Riskin, PE, 3rd Edition, 2004.
4. "Signals and Systems", A.V. Oppenheim, A.S. Willsky and S. H. Nawab, PHI, 2nd Edition, 2013.
5. "Signals and Systems", A. Anand Kumar, PHI Publications, 3rd Edition, 2013.

OPEN ELECTIVE – II

Course Code	ENVIRONMENTAL POLLUTION AND CONTROL		L	T	P	C
21A010502			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart knowledge on aspects of air pollution & control and noise pollution.
- To impart concepts of treatment of waste water from industrial source.
- To differentiate the solid and hazardous waste based on characterization.
- To introduce sanitation methods essential for protection of community health.
- To provide basic knowledge on sustainable development.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the fundamentals of solid waste management, practices adopted in his town / village and its importance in keeping the health of the city. **(K2)**

CO2: Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards**. (K2)**

CO3: Differentiate the treatment techniques used for sewage and industrial wastewater Treatment. **(K3)**

CO4: Integrate the methods of environmental sanitation and the management of community facilities without spread of epidemics. **(K6)**

CO5: Appraise the importance of sustainable development while planning a project or executing an activity. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

AIR POLLUTION:

Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

Learning Outcomes: At the end of this unit, students should be able to

- Understand control mechanism of air pollutants. (L2)
- Design noise reduction techniques. (L6)

UNIT – II (9 Hrs)

INDUSTRIAL WASTE WATER MANAGEMENT:

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of treatment process of industrial effluents. (L2)
- Design treatment plants. (L6)

UNIT – III (9 Hrs)

SOLID WASTE MANAGEMENT: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

HAZARDOUS WASTE: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Learning Outcomes: At the end of this unit, students should be able to

- Categorize of solid waste and separation and procession solid waste. (L4)
- Estimate Hazardous wastes. (L5)
- Develop execute solid waste and hazardous waste management. (L6)

UNIT – IV (9 Hrs)

ENVIRONMENTAL SANITATION: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of hygienic environment. (L2)
- Choose appropriate rural sanitation methods to keep surrounding clean. (L5)

UNIT – V (9 Hrs)

SUSTAINABLE DEVELOPMENT: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability– Industrialization and sustainable development – Cleaner production in achieving sustainability-sustainable development.

Learning Outcomes: At the end of this unit, students should be able to

- Express sustainable development strategies. (L6)

TEXTBOOKS:

1. "Environmental Engineering", Peavy, H. S., Rowe, D.R, Tchobanoglous, Mc-Graw Hill International Editions, New York 1985.
2. "Environmental Science and Engineering", J. G. Henry and G. W. Heinke, Pearson Education.

REFERENCE BOOKS:

1. "Waste water treatment- concepts and design approach", G. L. Karia and R.A. Christian, Prentice Hall of India
2. "Air pollution", M. N. Rao and H. V. N. Rao, Tata Mc.Graw Hill Company.
3. "Weiner and Robin Matthews Environmental Engineering", Ruth F., Elesevier, 4th Edition, 2003.
4. "Air Pollution and Control", K. V. S. G. Murali Krishna, Kousal & Co. Publications, New Delhi.

Course Code	SMART GRID		L	T	P	C
21A020503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Impart knowledge on relevance smart grids technologies, its potential challenges and applications to the real world.
- Provide deeper insight on the customer's needs and consumption pattern for better load management and forecasting.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operational and functional aspects of smart grid, architecture and technical challenges. **(K2)**

CO2: Analyze the communication signals from various measuring units and sub-networks for monitoring secured operation adhering relevant standards. **(K4)**

CO3: Assess the various energy options and apply them for the sustainability of Smart grid. **(K2)**

CO4: Develop strategies for demand side management using various communication protocols. **(K3)**

CO5: Understand the challenges and relevant standards in interoperability and cyber security of Smart grid. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to Smart Grid: Introduction to smart grid as per National Institute Standards and Technology (NIST), smart grid architecture, functions of smart grid components, smart grid initiatives in India, technology drivers and challenges. Overview of the technologies required for smart grid and architecture of smart substation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concept of smart grid Technology. (L2)
- Explain Smart grid functions. (L3)
- Understand Smart grid architecture. (L2)

UNIT – II (9 Hrs)

Smart Grid Measurement Technology: Introduction, standards for information exchange, monitoring, smart meters, and measurement technologies, WAMS, PMUs, GIS and google mapping tools and multi-agent systems technology.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the measurement technologies. (L2)
- Explain the google mapping tools. (L3)
- Compare WAMS and PMU. (L3)

UNIT – III (9 Hrs)

Sustainable Energy Options for the Smart Grid: Renewable Energy Resources, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, Storage Technologies.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of Renewable energy source. (L3)
- Understand basic concept of Electric Vehicles. (L2)

UNIT – IV (9 Hrs)

Demand Side Management and Communication Technology: Introduction, Demand Side Management objectives and its classification. Communication technologies: IEEE 802X series. Layouts of Sub-networks: LAN, WAN, NAN, HAN and FAN and its comparison.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic concepts of management objectives. (L3)
- Compares the WAN, LAN, NAN, HAN. (L3)

UNIT – V (9 Hrs)

Interoperability, Standards and Cyber Security : Introduction, State-of-the-Art-Interoperability, Benefits and Challenges of Interoperability, Model for Interoperability in the Smart Grid Environment, Smart Grid Network Interoperability, Interoperability and Control of the Power Grid, Standards, Approach to Smart Grid Interoperability Standards, Smart Grid Cyber Security, Cyber Security State of the Art, Cyber Security Risks, cyber security concerns associated with Advanced Metering Infrastructure, Mitigation approach to cyber security risks.

Learning Outcomes: After successful completion of this unit, the students will be able to

- Understand basic Benefits and Challenges of Interoperability. (L2)
- Analyze Smart Grid Network Interoperability. (L4)

TEXTBOOKS:

1. "Smart Grid: Fundamentals of design and analysis", James Momoh, John Wiley & sons Inc, IEEE press, 2012

2. “Smart Grid: Technology and Applications”, Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons Inc., 2012.

REFERENCE BOOKS:

1. “Smart Grid: Integrating Renewable, Distributed & Efficient Energy”, Fereidoon P. Shoshonis, Academic Press, 2012
2. “The smart grid: Enabling energy efficiency and demand response”, Clark Grellings, Fairmont Press Inc, 2009.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/107/108107113/
2. https://smartgrid.ieee.org/resources/webinars

Course Code	ENERGY STORAGE SYSTEMS		L	T	P	C
21A020504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need for energy storage
- Understand about the fundamentals of ESS
- Know about types, features and benefits of ESS
- Know about various management and control including market potential of ESS
- Study about various applications of ESS

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: To get exposed to latest technology of ESS. **(K3)**

CO2: Understand the principle, features, and benefits of ESS. **(K2)**

CO3: Understand the marketing and management strategies of ESS in working environment. **(K2)**

CO4: Distinguish wide variety of applications of EES for practical applications. **(K2)**

CO5: Know about latest technology applications of Battery SCADA, which is going to be vital in future applications, trend in new and renewable energy source. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Fundamentals of ESS: Definitions, Characteristics of ESS, Electricity, and roles of ESSs, Emerging needs in ESS, Classification of ESSs, Roles of Electrical storage technologies.

Learning Outcomes: At the end of this unit, students should be able to

- To know about the fundamentals of ESS. (L4)
- To know about emerging needs and roles of ESS. (L4)
- To know about various classifications of ESS. (L4)
- To understand about roles of energy storage technologies. (L2)

UNIT – II (9 Hrs)

Types and Features of ESS Technologies: Mechanical storage systems, Electromechanical

storage systems, Chemical energy storage, Electrical storage systems, Thermal storage systems, standards for EES, Comparison of ESS technology storage systems, Power and discharge duration, Energy and power density, Storage operating cost, Power quality, Reactive power capability.

Learning Outcomes: At the end of this unit, students should be able to

- To understand about various types of ESS technologies. (L2)
- To understand about standards for ESS. (L2)
- To learn about power and discharge duration of ESS. (L2)
- To know about preliminaries of ESS operating cost. (L4)
- To understand about power quality issues and reactive power capability of ESS. (L2)

UNIT – III (9 Hrs)

Storage Benefits: Definitions, Applications, specifications, benefits, Electric energy time shift, Electric supply capacity, reserve capacity, voltage support, Electric service power quality and reliability, Incidental benefits, energy losses, access charges, Risk, dynamic operating benefits, p.f. correction, reduced air emissions, flexibility, energy benefits.

Learning Outcomes: At the end of this unit, students should be able to

- To know various storage benefits. (L4)
- To distinguish between application specific benefits and identical benefits. (L2)
- To understand about electric service power quality and reliability issues. (L2)
- To learn about energy benefits from storage systems. (L3)

UNIT – IV (9 Hrs)

EES Market and Management: Utility and Consumer use, Measurement and Control hierarchy, Internal configurations, External connections, Battery SCADA, Market potential, estimation, role of aggregators, Maximum market potential estimates, Demand change management, Time-of-use energy cost management, storage modularity.

Learning Outcomes: At the end of this unit, students should be able to

- To understand about management of ESS technologies. (L2)
- To distinguish between internal and external configuration of ESS. (L2)
- To know about battery SCADA system and storage modularity. (L4)
- To distinguish between demand change and time-of-use energy cost management. (L2)

UNIT – V (9 Hrs)

Applications of EES: Power Vs Energy, Capacity Vs energy applications, specific power and discharge durations, Electric supply applications, ancillary service applications, End user/utility customer applications, Distributed energy storage applications, Locational, Non-locational and incidental applications.

Learning Outcomes: At the end of this unit, students should be able to

- To know about various ESS. (L4)
- To distinguish between power, capacity, energy applications of ESS. (L2)
- To distinguish between electric supply and ancillary applications. (L2)
- To understand about the importance of distributed energy storage applications. (L2)

TEXTBOOKS:

1. "Energy Storage Benefits and Market Analysis", James M. Eyer, Joseph J. Iannucci and Garth P. Corey, Sandia National Laboratories, 2004
2. "The Electrical Energy Storage", IEC Market Strategy Board, White paper.

REFERENCE BOOKS:

1. "Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide", Jim Eyer, Garth Corey, Sandia National Laboratories", Feb 2010.

Course Code	AUTOMATION IN INDUSTRIES		L	T	P	C
21A030503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need of automation
- Classify various types of automated transmission lines and components of automation.
- List and understand various material handling systems.
- Design various types of automated assembly systems
- Explain various automatic inspection systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand principles and basic elements of automation. **(K2)**
CO2: Understand the Detroit automation and automated flow lines. **(K2)**
CO3: Learn the material handling technology and assembly systems. **(K1)**
CO4: Learn the control systems technology and its process in automation. **(K1)**
CO5: Understand the inspection, testing and PLC's in automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	3	1	2	1	-	-	-	-	-
CO2	3	-	-	-	2	2	1	-	2	-	-	-	-	-
CO3	3	-	-	-	1	1	1	-	1	-	-	-	-	-
CO4	2	2	3	-	3	2	2	-	2	-	-	-	-	-
CO5	2	-	-	-	2	1	2	-	1	-	-	-	-	-

UNIT – I (9 Hrs)

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break-Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in process.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the principles of production, investment, cost concepts in automation. (L2)

UNIT – II (10 Hrs)

Detroit-Type Automation: Automated Flow lines, Methods of Work-part Transport, Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations.

Analysis of Automated Flow Lines: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the types of automation method concepts and machining operations. (L2)

UNIT – III (11 Hrs)

Material handling and Identification Technologies: The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc.

Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multistation Assembly Machines, Analysis of a Single Station Assembly Machine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Apply the techniques of material handling and automated assembly systems. (L4)

UNIT – IV (7 Hrs)

Control Technologies in Automation: Industrial Control Systems, Process Industries Verses Discrete- Manufacturing Industries, Continuous Verses Discrete Control, Computer Process Control and its Forms. Computer Based Industrial Control: Introduction & Automatic Process Control, Building Blocks of Automation System: LAN, Analog & Digital I/O Modules, SCADA System & RTU.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the industrial control technologies in automation. (L2)

UNIT – V (8 Hrs)

Automated Inspection and Testing: Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods.

Programmable Logic Controllers (PLCs): Introduction, Micro PLC, Programming a PLC, Logic Functions, Input & Output Modules, PLC Processors, PLC Instructions, Documenting a PLC System, Timer & Counter Instructions, Typical PLC Programming Exercises for Industrial Applications.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain the inspection, testing methods and PLC's methods in automation. (L2)

TEXTBOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing", M. P. Grover, Pearson Education.

REFERENCE BOOKS:

1. "Computer Based Industrial Control", Krishna Kant, EEE-PHI
2. "Principles and Applications of PLC", Webb John, Mcmillan 1992
3. "An Introduction to Automated Process Planning Systems", Tiess Chiu Chang & Richard A. Wysk
4. "Anatomy of Automation", Amber G.H & P.S. Amber, Prentice Hall.

<table>
<tr><td>Course Code</td><td rowspan="2">RAPID PROTOTYPING</td><td colspan="2">L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A030504</td><td colspan="2">3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">VI</td></tr>
</table>

COURSE OBJECTIVES:

- The fundamental Theory behind RP process.
- Study the Process parameters of different machine.
- Study different types of Rapid tooling.
- Based on the industrial standards, learn how Prepare manufacturing DATA.
- The basics concept of different software used in RP system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Theory behind RP process. **(K2)**
CO2: Learn the Process parameters of different machine. **(K3)**
CO3: Learn different types of Rapid tooling. **(K3)**
CO4: Understand the industrial standards; learn how to prepare manufacturing Data. **(K2)**
CO5: Understand basics concept of different software used in RP system. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	2	3	1	2	-	-	1	-	-	-	-
CO2	2	2	-	3	2	2	2	-	-	1	-	-	-	-
CO3	3	2	-	3	2	1	3	-	-	1	-	-	-	-
CO4	1	2	-	3	3	1	3	-	-	1	-	-	-	-
CO5	1	2	-	3	3	1	3	-	-	1	-	-	-	-

UNIT – I (9 Hrs)

Introduction & History of Rapid Prototyping, Fundamentals of Rapid Prototyping, Advantages and Disadvantages of Rapid Prototyping, Applications of Rapid Prototyping, Classification of RP, Rapid prototyping process chain, Fundamental Automated processes.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the importance of rapid prototyping. (L1)
- Understand the concept of Stereo lithography. (L2)

UNIT – II (9 Hrs)

Stereo lithography (SLA) system & principle, Process parameter, process details of SLA, Data preparation, data files of SLA, Machine details & Application of SLA.

Selective Laser Sintering (SLS)- Introduction, SLS Machine Type – Details, SLS principle of operation, Process parameters of SLS, Data preparation for SLS.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about the selective laser sintering process. (L4)
- Explain about the concept of fused deposition modelling and solid ground curing. (L2)

<u>UNIT – III</u> (7 Hrs)

Fused Deposition Modeling (FDM) – Introduction, FDM Principles, Process Parameters, Path generation & Application of FDM, Solid Ground curing (SGC) - Principle of operation, SGC machine details & application. Laminate Object Manufacturing (LOM) - Principle of operation, LOM materials, LOM Process details & Application.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Demonstrate about laminated object manufacturing process. (L2)
- Know about different 3D modelling printing techniques. (L1)

<u>UNIT – IV</u> (10 Hrs)

Rapid tooling -Indirect rapid tooling, Silicon Rubber tooling, Aluminium filling epoxy tooling, Spray metal tooling, Direct rapid tooling, Quick cast process, copper Polyamide, DMILS – explanation, Prometals, sand casting tooling, Soft tooling & hard tooling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of rapid tolling. (L2)

<u>UNIT – V</u> (10 Hrs)

Rapid Manufacturing – Introduction, Factors influencing accuracy, Data preparation errors, Part building errors, Errors in finishing, Influence of build orientation.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand different file format software's of 3D modelling techniques. (L2)

<u>TEXTBOOKS</u>:

1. "Stereo lithography and other RP & M Technologies", Paul F. Jacobs, SME, NY 1996.
2. "Rapid Manufacturing", Flham D. T & Dinjoy S.S, Verlog London 2001.
3. "Rapid automated", Lament wood, Indus press New York.

<u>REFERENCE BOOKS:</u>

1. "Wohler's Report 2000", Terry Wohlers, Wohler's Association, 2000.
2. "Rapid prototyping materials", Gurumurthi, IISc Bangalore

Course Code	PRINCIPLES OF COMMUNICATION SYSTEMS		L	T	P	C
21A040503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concept of amplitude modulation to solve engineering problems. **(K3)**
CO2: Analyze the Angle modulation & demodulation systems in time & frequency domains. **(K4)**
CO3: Analyze different Analog Pulse modulation & demodulation techniques. **(K4)**
CO4: Explain various digital modulation schemes. **(K3)**
CO5: Understand the concept of various communication systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Amplitude Modulation: An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of noise, Fourier transform, career modulation and frequency division multiplexing. (L2)
- Apply the concept of amplitude modulation to solve engineering problems. (L3)

UNIT – II (9 Hrs)

Angle Modulation: Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of angle modulation and its components. (L2)
- Apply the concept of frequency modulation to solve engineering problems. (L3)
- Analyse angle modulation schemes. (L4)
- Evaluate frequency modulation scheme in real time applications. (L4)

<u>UNIT – III</u> (8 Hrs)

Pulse Modulation: Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing. (L2)
- Explain various pulse modulation schemes. (L4)

<u>UNIT – IV</u> (9 Hrs)

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various digital modulation schemes. (L2)
- Analyze various digital modulation schemes. (L4)

<u>UNIT – V</u> (9 Hrs)

Communication Systems: Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various communication systems. (L2)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

<u>TEXTBOOKS:</u>

1. “Principles of Communication Systems”, Herbert Taub, Donald L Schilling and Goutam Saha, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

<u>REFERENCE BOOKS:</u>

1. “Modern Digital and Analog Communication Systems”, B. P. Lathi, Zhi Ding and Hari M. Gupta, 4th Edition, Oxford University Press, 2017.

2. "Digital and Analog Communication Systems", K. Sam Shanmugam, Wiley India Edition, 2008.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108104091
2. https://www.eeeguide.com/principles-of-communication-systems
3. https://ncert.nic.in/ncerts/l/leph207.pdf

Course Code	ELECTRONIC INSTRUMENTATION		L	T	P	C
21A040504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To introduce various measuring instruments and their functionality.
- To teach various measurement metrics for performance analysis.
- To explain principles of operation and working of different electronic instruments.
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.
- To provide exposure to different types of transducers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the different methods for measurement of various electrical quantities. **(K2)**
CO2: Compare the various measuring techniques for measuring voltage. **(K4)**
CO3: Measure amplitude and frequency utilizing oscilloscopes. **(K5)**
CO4: Analyze the functioning of various types of probes, derive the balanced condition for various bridges. **(K4)**
CO5: Measure various physical parameters by appropriately selecting the transducers. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (10 Hrs)

Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. **Ammeters:** DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. **Voltmeters and Multi-meters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of measurement system. (L2)
- Explain the characteristics of different Instruments. (L2)

- Illustrate different types of errors that may occur in instruments during measurements. (L2)

UNIT – II (9 Hrs)

Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM.

Digital Instruments: Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

Learning Outcomes: At the end of this unit, students should be able to

- Explain working of digital measuring Instruments. (L2)
- Compare the various measuring techniques for measuring voltage. (L4)

UNIT – III (9 Hrs)

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope.

Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator.

Learning Outcomes: At the end of this unit, students should be able to

- Measure parameters viz. Amplitude, frequency and time period using CRO. (L5)
- Classify signal generators and describe its characteristics. (L2)

UNIT – IV (8 Hrs)

Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger.

Bridges: Introduction, Wheatstone‘s bridge, Kelvin‘s Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell‘s bridge, Wien‘s bridge.

Learning Outcomes: At the end of this unit, students should be able to

- Describe function of various measuring Instruments. (L2)
- Describe how unknown capacitance and inductance can be measured using bridges. (L2)
- Select appropriate bridge for measuring R, L and C parameters. (L2)
- Analyze the functioning of various types of probes derive the balanced condition for various bridges. (L4)

UNIT – V (9 Hrs)

Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive

transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of transducer. (L2)
- Measure various physical parameters by appropriately selecting the transducers. (L5)

TEXTBOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, McGraw Hill, 3rd Edition, 2012, ISBN: 9780070702066.
2. "Modern Electronic Instrumentation and Measuring Techniques", A. D. Helfrick and W.D. Cooper, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

REFERENCE BOOKS:

1. "Electronic Instrumentation & Measurements", David A. Bell, Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.
2. "Electronics and Electrical Measurements", A. K. Sawhney, Dhanpat Rai &Sons. ISBN - 81-7700-016-0

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/108105064/
2. http://nptel.ac.in/courses/108105062/

OPEN ELECTIVE – III

Course Code	DISASTER MANAGEMENT AND MITIGATION		L	T	P	C
21A010503			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To obtain the basic knowledge of Environmental Hazards and disasters.
- To understand the basics of Endogenous and Exogenous hazards and gives a suitable picture on the different types of hazard and disaster mitigation methods.
- To understand the key concepts of disaster management related to development and the relationship of different disaster management activities.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze and evaluate the environmental, social, cultural, economic, legal and organizational Aspects influencing vulnerabilities and capacities to face disasters and to know about different types of environmental hazards. **(K4)**

CO2: Compute knowledge on different types of natural and man- made disasters. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery). **(K3)**

CO3: Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ. **(K3)**

CO4: Identify endogenous and exogenous hazards their harmful effects to the environment, Case studies of India. **(K1)**

CO5: Identify the regulatory controls used in hazard management. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO2	3	3	3	3	-	-	2	1	-	-	2	-	2	-
CO3	3	3	3	3	-	-	2	2	-	-	2	-	2	-
CO4	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO5	3	3	2	3	-	-	2	1	-	-	2	-	3	-

UNIT – I (8 Hrs)

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Learning Outcomes: At the end of this unit, students should be able to

- Debate on the Knowledge of the disaster phenomenon, its different contextual aspects, impacts and public health consequences. (L5)
- Express about the natural hazards and its management. (L6)

UNIT – II (10 Hrs)

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

Learning Outcomes: At the end of this unit, students should be able to

- Explain the Capacity to manage the Public Health aspects of the disasters. (L4)
- Distinguish the different types of environmental hazards & disasters. (L5)

UNIT – III (9 Hrs)

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the regulations of building codes and land use planning related to risk and vulnerability. (L4)
- Justify the financial management of disaster and related losses. (L6)

UNIT – IV (9 Hrs)

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Mitigation and control measures of exogenous hazards. (L2)
- Analyze, and communicate information on risks, relief needs and order to formulate strategies for mitigation. (L4)

UNIT – V (9 Hrs)

Soil Erosion: - Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion. Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation. Biological hazards/ disasters:- Population Explosion.

Learning Outcomes: At the end of this unit, students should be able to

- Relate their interconnections, particularly in the field of the Public Health aspects of the disasters. (L3)
- Understand different approaches to prevent disasters. (L2)

TEXTBOOKS:

1. "Disaster Management", Rajib Shah, Universities Press, India, 2003
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Disaster Mitigation: Experiences and Reflections", Pardeep Sahni
4. "Natural Hazards & Disasters", Donald Hyndman & David Hyndman, Cengage Learning.

REFERENCE BOOKS:

1. "The Environment as Hazards", Kates, B.I & White, G.F, Oxford Publishers, New York, 1978
2. "Disaster Management", R.B. Singh (Ed), Rawat Publication, New Delhi, 2000
3. "Disaster Management", H.K. Gupta (Ed), Universities Press, India, 2003
4. "Space Technology for Disaster Mitigation in India (INCED)", R.B. Singh, University of Tokyo, 1994.

ONLINE LEARNING RESOURCES:

1. http://ndma.gov.in
2. http://www.ndrf.gov.in

Course Code	RENEWABLE ENERGY SYSTEMS		L	T	P	C
21A020505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand various alternate sources of energy for different suitable application requirements. **(K2)**

CO2: Understand the concepts of solar energy generation strategies and wind energy system. **(K2)**

CO3: Analyze Solar and Wind energy systems. **(K4)**

CO4: Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass, and fuel cells. **(K2)**

CO5: Understand the fundamentals of Solar and Wind energy systems. **(K2)**

CO-POMAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

Learning Outcomes: At the end of this unit, students should be able to

- Understanding renewable and nonrenewable energy resources. (L2)
- Understand the various forms of conventional energy resources. (L2)
- Understanding of Solar power properties. (L2)

UNIT – II (8 Hrs)

PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the PV cells and modules. (L2)
- Disseminate information on PV. (L3)

UNIT – III (10 Hrs)

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

Learning Outcomes: At the end of this unit, students should be able to

- Understanding of wind energy production. (L2)
- Outline division aspects and utilization of renewable energy sources for both domestics and industrial application. (L3)
- Understand the need of Wind Energy and the various components used in energy generation and know the classification. (L2)

UNIT – IV (8 Hrs)

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the Resources of geothermal energy.(L2)

UNIT – V (10 Hrs)

Miscellaneous Energy Technologies: Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Biomass energy resources and their classification. (L2)
- Analyze the performance of Ocean Energy. (L4)

TEXTBOOKS:

1. "Renewable Energy Power for a Sustainable Future", Stephen Peake, Oxford International Edition, 2018.
2. "Non-Conventional Energy Sources", G. D. Rai, Khanna Publishers, 4th Edition, 2000.

REFERENCE BOOKS:

1. "Solar Energy", S. P. Sukhatme, Tata Mc Graw Hill Education Pvt. Ltd, 3rd Edition, 2008.
2. "Non-Conventional Energy Resources", B H Khan, Tata Mc Graw Hill Education Pvt Ltd, 2nd Edition, 2011.
3. "Non-Conventional Energy Resources", S. Hasan Saeed and D. K. Sharma, S. K. Kataria & Sons, 3rd Edition, 2012
4. "Renewable Energy Resource: Basic Principles and Applications", G. N. Tiwari and M. K. Ghosal, Narosa Publishing House, 2004

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

Course Code	CONCEPTS OF ELECTRICAL DRIVES AND APPLICATIONS		L	T	P	C
21A020506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:
- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

COURSE OUTCOMES:
After completion of the course, the student will be able to

CO1: Identify the choice of the electric drive system based on their applications. **(K2)**
CO2: Explain the operation of single and multi-quadrant electric drive. **(K3)**
CO3: Analyze single phase and 3-phase rectifiers fed DC motors and chopper fed DC motors. **(K4)**
CO4: Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors with closed loop, and open loop operations. **(K3)**
CO5: Explain the speed control methods for AC-AC & DC-AC converters fed to Synchronous motors with closed loop, and open loop operations. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Converter Fed DC Motors: Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase semi and fully controlled converters connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic electrical drive elements and its function. (L2)
- Analyze the single-phase dc drives and its speed-torque characteristics. (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – II (9 Hrs)

Four Quadrant Operation of DC Drives: Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the four-quadrant operation of the dc drives. (L2)
- Analyze the various motoring and braking operations of the dc motors. (L4)
- Understand the closed loop operation of the dc drives. (L2)

UNIT – III (9 Hrs)

Chopper fed DC Motors: Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics– Problems on Chopper Fed D.C Motors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basics concepts of choppers and its operation. (L2)
- Analyze the classification of various choppers feeding the dc drives. (L4)

UNIT – IV (9 Hrs)

Control of Induction Motor: Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers–Waveforms – Speed Torque Characteristics - Stator Frequency Control and characteristics. Voltage Source and Current Source Inverter – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Static Rotor Resistance Control

Learning Outcomes: At the end of this unit, students should be able to

- Understand the various speed control methods of induction motor used in drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods to induction motor on rotor side. (L3)

UNIT – V (9 Hrs)

Control of Synchronous Motors: Separate Control & Self Control of Synchronous Motors – Operation of Self-Controlled Synchronous Motors by VSI and CSI. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque Characteristics – Applications – Advantages.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the self and separate control methods of synchronous motor drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods of synchronous motors. (L4)

TEXTBOOKS:

1. "Power semiconductor-controlled drives", G K Dubey, Prentice Hall, 1995.
2. "Modern Power Electronics and AC Drives", B. K. Bose, PHI, 2002.

REFERENCE BOOKS:

1. "Power Electronics", MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. "Power Electronic Circuits, Devices and applications", M. H. Rashid, PHI, 2005.
3. "Electric drives Concepts and Applications", Vedam Subramanyam, Tata McGraw Hill Publications, 2nd Edition, 2011.

Course Code	OPTIMIZATION TECHNIQUES		L	T	P	C
21A030505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the basic fundamentals of optimization methods that can be used during a design process.
- To expose the students to different modern optimization techniques.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand basic theoretical principles of optimization models and its solution. **(K2)**
CO2: Formulate the given practical problem and solving by graphical /simplex method. **(K3)**
CO3: Analyse the cost for transportation and assigning the jobs to machines. **(K3)**
CO4: Analyse the cost and duration of the project, also preparation of job scheduling. **(K3)**
CO5: Use latest methods for optimization. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	1	2	2	1	-	-
CO2	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO3	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO4	3	3	3	3	-	2	-	1	1	-	2	1	-	-
CO5	3	3	3	3	2	2	-	-	2	-	2	1	-	-

UNIT – I (10 Hrs)

Introduction to Optimization: Classification of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems.

Classical Optimization Techniques: Single variable optimization, Multi-variable: Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions

Learning Outcomes: At the end of this unit, students should be able to

- Explain how to formulate statement of optimization problem with or without constraints. (L3)
- Explain about classification of single and multivariable optimization problems. (L3)
- Know about necessary and sufficient conditions in defining the optimization problems. (L1)
- Understand how to formulate Kuhn-Tucker conditions and to solve numerical problems. (L3)

UNIT – II (8 Hrs)

Linear Programming: Statement of an LP problem, Graphical Solution of an LP problem, Simplex method, Two phase method, Dual simplex method.

Learning Outcomes: At the end of this unit, students should be able to

- Formulation of problem as LPP. (L4)
- Solve numerical problems with graphical method, Simplex method, two phase method and dual simplex method. (L4)

UNIT – III (9 Hrs)

Transportation Problems: Introduction, Optimal Solution for BFS, Unbalanced Transportation Problem, Transshipment, Assignment Problems, Hungarian Method.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Model linear programming problems like the transportation. (L6)
- Solve the problems of transportation from origins to destinations with minimum time and cost. (L3)
- Solve assignment problems. (L4)

UNIT – IV (10 Hrs)

Project Management: Introduction, Critical Path Method, Critical Path Determination, Optimal Scheduling by CPM, Project Evaluation and Review Technique.

Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

Learning Outcomes: At the end of this unit, students should be able to

- Represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project. (L4)
- Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability. (L4)
- Solve problems of production scheduling. (L3)

UNIT – V (8 Hrs)

Modern Methods of Optimization: An overview of evolutionary algorithms, Genetic algorithms, simulated annealing, fuzzy optimization, neural-network based methods, Particle swarm optimization.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Solve the numerical problems using modern optimization techniques. (L4)

TEXTBOOKS:

1. "Engineering Optimization- Methods and Applications", A. Ravindran, K. M. Ragsdell, G.V. Reklaitis, Wiley India Edition, 2nd Edition.
2. "Operations Research: An Introduction", H.A. Taha, PHI Pvt. Ltd., 6th Edition

REFERENCE BOOKS:

1. "Introduction to Optimum Design", J S Arora, Mc-Graw Hill.
2. "Optimization Methods for Engineering Design", Fox, R. L., Addison Wesley, 2001.
3. "Multi-objective optimization using evolutionary algorithms", K Deb John Wiley Publications.
4. "Operations Research", Dr. J. K. Sharma, Mc Millan.
5. "Engineering Optimization: Theory and Practice", Singiresu S. Rao, John Wiley & Sons

Course Code	GLOBAL WARMING AND CLIMATE CHANGES		L	T	P	C
21A030506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To know the basics, importance of global warming.
- To know the concepts of mitigation measures against global warming
- To know the impacts of climate changes

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know the impact of Ozone layer on green house effect and global warming. **(K1)**
CO2: Understand the structure of atmosphere and effects of inversion on pollution dispersion. **(K2)**
CO3: Know the effect of global warming and climatic changes on environment. **(K1)**
CO4: Understand Global change in temperature and climate and measures to reduce the effect. **(K2)**
CO5: Understand the clean technology, use of renewable energy, mitigation technologies and their practices **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO5	1	2	-	2	-	-	-	-	2	-	-	2	-	-

UNIT – I (7 Hrs)

EARTH'S CLIMATE SYSTEM:

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Green house gases and green house effect, Hydrological cycle and Carbon cycle, Global warming and its impacts

Learning Outcomes: At the end of this unit, students should be able to

- Identity the importance of Ozone and effect of green house gases. (L1)
- Know the effect of global warming. (L1)

UNIT – II (9 Hrs)

ATMOSPHERE & ITS COMPONENTS: Atmosphere and its layers-Characteristics of Atmosphere - Structure of Atmosphere - Composition of Atmosphere - Atmospheric stability -

Temperature profile of the atmosphere - Temperature inversion and effects of inversion on pollution dispersion.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the layers of atmosphere and their characteristics. (L1)

<u>UNIT – III</u> (8 Hrs)

IMPACTS OF CLIMATE CHANGE: Causes of Climate change - Change of Temperature in the environment - Melting of ice and sea level rise - Impacts of Climate Change on various sectors - Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and its effects on various sectors. (L1)

<u>UNIT – IV</u> (10 Hrs)

OBSERVED CHANGES AND ITS CAUSES: Climate change and Carbon credits-Clean Development Mechanism (CDM), CDM in India - Kyoto Protocol - Intergovernmental Panel on Climate Change (IPCC) - Climate Sensitivity - Montreal Protocol - United Nations Framework Convention on Climate Change (UNFCCC) - Global change in temperature and climate and changes within India

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and carbon credits, effect of change in temperature and climate on India. (L1)

<u>UNIT – V</u> (11 Hrs)

CLIMATE CHANGE AND MITIGATION MEASURES: CDM and Carbon Trading - Clean Technology, biodiesel, compost, biodegradable plastics - Renewable energy usage as an alternative - Mitigation Technologies and Practices within India and around the world - Non-renewable energy supply to all sectors - Carbon sequestration - International and regional cooperation for waste disposal biomedical wastes, hazardous wastes, e-wastes, industrial wastes, etc.,

Learning Outcomes: At the end of this unit, students should be able to

- Know about the clean technology, use of renewable energy, mitigation technologies and their practices. (L1)

<u>TEXTBOOKS:</u>

1. "Climate Change – An Indian Perspective", Dash Sushil Kumar, Cambridge University Press India Private limited 2007.

REFERENCE BOOKS:

1. "Adaptation and mitigation of climate change-Scientific Technical Analysis", Cambridge University Press, Cambridge, 2006.
2. "Atmospheric Science", J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3. "Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Jan C. van Dam, Cambridge university press, 2003.
4. "Global Warming: Understanding the Forecast"", David Archer, Wiley, 2nd Edition, 2011
5. "Global Warming: The Complete Briefing", John Houghton, Cambridge University Press, 5th Edition, 2015

Course Code	ELECTRONIC SENSORS		L	T	P	C
21A040505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To learn the characterization of sensors.
- To know the working of Electromechanical, Thermal, Magnetic and radiation sensors
- To understand the concepts of Electro analytic and smart sensors
- To be able to use sensors in different applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the Principles of different sensors, Characterization and working of Electro mechanical Sensors. **(K3)**
CO2: Analyze the working of Thermal sensors. **(K4)**
CO3: Compare the working of magnetic resistor and hall effect sensors. **(K4)**
CO4: Explain the working of radiation and Electro analytic Sensors. **(K3)**
CO5: Develop a system with smart sensors. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (9 Hrs)

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of sensors/Transducers principles. (L2)
- Understand the concepts of Electro mechanical sensors. (L2)
- Identify the operation of Inductive and capacitive sensors. (L3)

UNIT – II (9 Hrs)

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Thermal sensors. (L2)
- Understand the working of Thermal radiation sensors. (L2)
- Identify the types of semiconductor sensors. (L3)
- Analyse the operation of heat flux sensors. (L4)

UNIT – III (9 Hrs)

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principles of Magnetic sensors. (L2)
- Summarize the concepts of Angular transducers. (L2)
- Compare the working of magnetic resistor and Hall effect sensors. (L4)

UNIT – IV (9 Hrs)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors, Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of radiation sensors. (L2)
- Summarize the types of photo detectors. (L2)
- Explain different electrodes and sensors. (L3)

UNIT – V (9 Hrs)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications, Introduction- On-board Automobile

Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of smart sensors. (L2)
- Summarize the applications of automation sensor. (L2)
- Develop different sensors used in the industries and manufacturing. (L3)

TEXTBOOKS:

1. "Sensors and Transducers", D. Patranabis, PHI Learning Private Limited., 2003.
2. "Introduction to sensors", John veteline, Aravind Raghu, CRC press, 2011

REFERENCE BOOKS:

1. "Sensors and Actuators", D. Patranabis, PHI, 2nd Edition, 2013.
2. "Make sensors", Tero Karvinen, Kimmo Karvinen and Ville Valtokari, Maker media, 1st Edition, 2014.
3. "Sensors handbook", Sabrie Soloman, TMH, 2nd Edition, 2009

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108147
2. http://www.nitttrc.edu.in/nptel/courses/video/101104066/101104066.html

Course Code	INTRODUCTION TO IMAGE PROCESSING		L	T	P	C
21A040506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce fundamentals of Image Processing.
- To expose various intensity transformations in spatial and frequency domains.
- To impart concepts of wavelets and various coding techniques for image compression.
- To dissimilate various segmentation techniques for images.
- To teach various color models and to introduce the concepts of color image segmentation.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various types of images mathematically. **(K4)**
CO2: Compare image enhancement methods in spatial and frequency domains. **(K3)**
CO3: Apply various segmentation algorithms for processing an image. **(K3)**
CO4: Categorize various compression techniques and color models. **(K4)**
CO5: Apply various techniques for color image smoothing, sharpening and segmentation. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO4	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels: neighbourhood, adjacency, connectivity, distance measures. Mathematical tools/ operations applied on images.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic building blocks of image processing. (L2)
- Define image processing parameters such as adjacency and distance measures. (L1)
- Analyze various types of images mathematically. (L4)

UNIT – II (9 Hrs)

Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain

sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Learning Outcomes: At the end of this unit, students should be able to

- Apply spatial domain and frequency Domain filtering techniques for image enhancement (L3)
- Compare image enhancement methods in spatial and frequency domains. (L3)

UNIT – III (9 Hrs)

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various Image segmentation techniques. (L2)
- Illustrate detection of discontinuities in an image. (L2)
- Apply various segmentation algorithms for processing an image. (L3)

UNIT – IV (9 Hrs)

Image Compression: Redundancy, inter-pixel and psycho-visual; Loss less compression-predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various transform techniques for lossy compression. (L2)
- Apply various coding techniques for lossless compression. (L3)

UNIT – V (9 Hrs)

Color Image Processing: Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various color models for color image processing. (L2)
- Apply various techniques for color image smoothing, sharpening and segmentation. (L3)

TEXTBOOKS:

1. "Digital Image Processing", R.C. Gonzalez and R.E. Woods, Pearson Education, 2nd Edition, 2008.
2. "Fundamentals of Digital Image Processing", Anil Kumar Jain, Prentice Hall of India, 2nd Edition 2004.

REFERENCE BOOKS:

1. "Digital Image processing using MATLAB", Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Tata McGraw Hill, 2010.
2. "Image Processing, Analysis, and Machine Vision", Milan Sonka, Vaclav Hlavac, Roger Boule, Cengage Learning, 3rd Edition, 2016.
3. "Digital Image processing", S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.
4. "Digital Image Processing", William K. Pratt, John Wiley, 3rd Edition, 2004.

ONLINE LEARNING RESOURCES:

1. https://www.udemy.com/course/learn-image-analysis/
2. https://alison.com/tag/image-processing
3. https://nptel.ac.in/courses/117/105/117105135/

OPEN ELECTIVE – IV

Course Code	COST EFFECTIVE HOUSING TECHNIQUES		L	T	P	C
21A010504			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To train the students to have a comprehensive knowledge of planning, design, evaluation, construction
- To train the students to financing of housing projects
- To Provide Knowledge on cost effective construction materials and methods.
- To teach the principles of sustainable housing policies and programmes.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand about planning, design, evaluation, construction and financing of housing projects with cost effective housing techniques. **(K2)**

CO2: Choose the basic housing programmes and services and slum improvement and relocation. **(K3)**

CO3: The student can be in a position to adopt the suitable techniques in construction of low cost constructions. **(K6)**

CO4: Understand about alternate building materials for low cost housing techniques and sanitation services in rural areas. **(K2)**

CO5: The student can be in a position to analyze the suitable techniques in rural and disaster prone areas by using locally available materials. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

INTRODUCTION TO HOUSING: Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the about basics about housing norms. (L4)

- Understand the objectives and strategies of housing policies. (L2)

UNIT – II (9 Hrs)

HOUSING PROGRAMMES: Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate the usage of GIS and MIS in housing projects. (L4)
- Explain about development of plots and gated communities. (L4)

UNIT – III (9 Hrs)

DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY: Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements - Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall - Fly ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

Learning Outcomes: At the end of this unit, students should be able to

- Write about the adoption of Economical Wall System. (L6)
- Write about Adoption of precast R.C. plank and join system for roof/floor in the building. (L6)

UNIT – IV (9 Hrs)

ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING AND INFRASTRUCTURE SERVICES IN RURAL HOUSES: Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Low cost Infrastructure services: Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy. Rural Housing**:** Introduction traditional practice of rural housing continuous - Mud Housing technology-Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs.

Learning Outcomes: At the end of this unit, students should be able to

- Determine about alternate building materials for low cost housing construction. (L3)

- Justify about low cost sanitation from traditional methods. (L6)

UNIT – V (9 Hrs)

HOUSING IN DISASTER PRONE AREAS: Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirements of structural safety of thin pre-cost roofing units against Earthquake forces -Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about Type of Damages and Railways of non-engineered buildings. (L4)
- Express about Repair and restore action of earthquake Damaged structures and for future constructions. (L6)

TEXTBOOKS:

1. "Hand book of Low Cost Housing", A. K. Lal, New Age International publishers.
2. "Low Cost Housing", G.C. Mathur, IBH Publishers.
3. "Housing in India", Francis Cherunilam and Odeyar D Heggade, Himalaya Publishing House, Bombay, 1997.

REFERENCE BOOKS:

1. "Disaster Management", Rajib Shaw, Universities Press, India.
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Building Materials For Low–Income Houses", International Council For Building Research Studies And Documentation.
4. "Modern Trends In Housing In Developing Countries", A.G. Madhava Rao, D.S. Rama Chandra Murthy & G. Annamalai.
5. "Properties of Concrete"', Neville A.M. Pitman Publishing Limited, London.
6. "Light Weight Concrete", Academic Kiado, Rudhai.G, Publishing home of Hungarian Academy of Sciences, 1963.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/124107001
2. https://nptel.ac.in/courses/105103206
3. https://onlinecourses.nptel.ac.in/noc20_ar14/preview4

<table>
<tr><td>Course Code</td><td rowspan="2">ENERGY CONSERVATION AND MANAGEMENT</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A020507</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">VII</td></tr>
</table>

COURSE OBJECTIVES:

- Familiarize present energy scenario, and energy auditing methods.
- Explain components of electrical systems, lighting systems and improvements in performance. Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
- Train on energy conservation in major utilities.
- Instruct principles of energy management and energy pricing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain Energy Utilization and Energy Auditing Methods. **(K3)**

CO2: Analyse Electrical Systems Performance of Electric Motors and Lighting Systems. **(K4)**

CO3: Examine Energy Conservation Methods in Thermal Systems. **(K3)**

CO4: Estimate Efficiency of Major Utilities Such as Fans, Pumps, Compressed Air Systems, Havoc and D.G. Sets. **(K2)**

CO5: Elaborate Principles of Energy Management, Programs, Energy Demand and Energy Pricing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction: Energy – Power – Past & Present Scenario of World; National Energy Consumption Data – Environmental Aspects Associated with Energy Utilization –Energy Auditing: Need, Types, Methodology And Barriers. Role of Energy Managers, Instruments for energy auditing.

Learning Outcomes: At the end of this unit, students should be able to

- Infer energy consumption patterns and environmental aspects of energy utilization. (L4)
- Outline energy auditing requirements, tools, and methods. (L3)
- Identify the function of energy manager. (L2)

UNIT – II (9 Hrs)

Electrical Systems: Components of EB Billing – HT And LT Supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of Lighting, Efficacy, LED Lighting And Scope Of Economy In Illumination.

Learning Outcomes: At the end of this unit, students should be able to

- Outline components of electricity billing, transmission, and distribution. (L3)
- Analyse performance characteristics of transformers, capacitors, and electric motors. (L4)
- Examine power factor improvements, and electric motor efficiency. (L3)
- Evaluate lighting systems. (L4)

UNIT – III (9 Hrs)

Thermal Systems: Stoichiometry, Boilers, Furnaces, and Thermic Fluid Heaters – Efficiency Computation and Encon Measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, and Insulators & Refractory's.

Learning Outcomes: At the end of this unit, students should be able to

- Determine efficiency of boilers, furnaces, and other thermal systems. (L3)
- Recommend energy conservation measures in thermal systems. (L2)
- Justify steam systems in energy conservation. (L3)

UNIT – IV (9 Hrs)

Energy Conservation in Major Utilities: Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. Sets.

Learning Outcomes: At the end of this unit, students should be able to

- Explain energy conservation measures in major utilities. (L3)
- Apply performance test criteria for fans, pumps, compressors, havoc systems. (L3)
- Assess energy conservation in cooling towers and D.G. sets. (L3)

UNIT – V (9 Hrs)

Energy Management: Principles of Energy Management, Energy demand estimation, Organizing and Managing Energy Management Programs, Energy pricing.

Learning Outcomes: At the end of this unit, students should be able to

- Describe principles of energy management. (L2)
- Assess energy demand and forecast, organize energy management programs. (L3)
- Design elements of energy pricing. (L5)

TEXTBOOKS:

1. "Energy Manager Training Manual", A Website Administered by Bureau of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government of India, 2004, 4 Volumes Available at ww.energymanagertraining.com

REFERENCE BOOKS:

1. "Industrial Energy Management and Utilisation", Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988.
2. "Design and Management for Energy Conservation", Callaghn, P.W., Pergamon Press, Oxford, 1981
3. "The Efficient Use of Energy", Dryden. I.G.C., Butter worths, London, 1982
4. "Energy Management", Murphy. W. R. and G. Mc Kay, Butter worths, London 1987

Course Code	BASICS OF POWER ELECTRONICS		L	T	P	C
21A020508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operation, characteristics, and usage of power semiconductor devices. **(K2)**
CO2: Understand different types of Rectifier circuits with different operating conditions. **(K2)**
CO3: Understand DC-DC converters operation and analysis of their characteristics. **(K2)**
CO4: Understand the construction and operation of voltage source inverters. **(K2)**
CO5: Apply all the above concepts to solve various numerical problem solving. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	1	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-	1	-

UNIT – I (9 Hrs)

Power Switching Devices: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

Learning Outcomes: At the end of this unit, students should be able to

- Know the V-I characteristics of different semi-conductor devices. (L4)
- Importance of drive circuit for MOSFET, IGBT and GTO. (L3)

UNIT – II (9 Hrs)

Rectifiers: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance.

Learning Outcomes: At the end of this unit, students should be able to

- Derivation of expressions of different configurations of rectifiers. (L3)
- Calculate the Average, R.M.S values of Voltages and Currents. (L4)

<u>UNIT – III</u> (8 Hrs)

DC-DC converters: Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of duty cycle. (L2)
- Analysis of waveforms at steady state of power circuit. (L4)
- Derivation of average output voltage of DC-DC converter. (L3)

<u>UNIT – IV</u> (9 Hrs)

Inverter: Single phase Voltage Source inverters– operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters –Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle operationally.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of pulse width modulation. (L2)
- Analysis of waveforms of single phase and three phase bridge inverters. (L4)

<u>UNIT – V</u> (10 Hrs)

AC voltage controllers & Cyclo converters: voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of TRIAC – TRIAC with R and RL loads– RMS load voltage, current and power actor-waveforms. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down Cyclo converters with Resistive load, Principle of operation, Waveforms, output voltage.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of the phase control and integral cycle control. (L2)
- Know the principal operation of voltage and frequency converter. (L4)
- Analysis waveforms of ac voltage converter and Cyclo converter. (L4)

<u>TEXTBOOKS:</u>

1. "Power Electronics: Circuits, Devices and Applications", M. H. Rashid, Prentice Hall of India, 2nd Edition, 1998

2. "Power Electronics", P. S. Bimbhra, Khanna Publishers, 4th Edition, 2010.
3. "Power Electronics", M. D. Singh & K. B. Khanchandani, Tata Mc Graw Hill Publishing Company, 1998.

REFERENCE BOOKS:

1. "Power Electronics", Ned Mohan, Wiley, 2011
2. "Fundamentals of Power Electronics", Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004
3. "Power Electronics", Vedam Subramanyam, New Age International (P) Limited, 1996.
4. "Power Electronics", V. R. Murthy, Oxford University Press, 1st Edition, 2005.
5. "Power Electronics", P. C. Sen, Tata Mc Graw-Hill Education, 1987
6. "Power Electronic Control of Alternating Current Motors", J. M. D. Murphy.

Course Code	BASICS OF AUTOMOTIVE ENGINEERING		L	T	P	C
21A030507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce various components of an automobile and engine sub systems.
- To impart knowledge on various safety systems of an automobile and emission norms.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the various components of an automobile and Working of fuel supply system. **(K2)**
CO2: Know the working of various lubrication and cooling systems. **(K1)**
CO3: Familiarize with the various systems such as ignition system and transmission system. **(K2)**
CO4: Explain the suspension, braking systems of an automobile and their differences. **(K2)**
CO5: Know about the emissions from engine and safety norms for the operation of an automobile. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction: classification of automobiles, Components of four wheeler automobile- chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive

Fuel supply systems: simple fuel supply system in petrol and diesel engines. Working of simple Carburetor, direct fuel injection system in diesel engine.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the parts of automobile engines. (L2)
- Understand the concept of fuel supply systems. (L2)

UNIT – II (7 Hrs)

Lubricating System: Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.

Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the function of Lubricating system. (L3)

UNIT – III (10 Hrs)

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, Electronic ignition system.

Transmission system: Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, Types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the concept of Ignition system and its types. (L2)
- Understand the concept of Transmission system. (L2)

UNIT – IV (10 Hrs)

Suspension System: Objectives of suspension system, front suspension system rigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the working of suspension system and its types. (L2)
- Analyze the different types of braking systems. (L3)

UNIT – V (9 Hrs)

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. Engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand emission concept in automobiles engines. (L2)
- Understand the concept of safety system. (L2)

TEXTBOOKS:

1. "Automobile Engineering Vol-1 & vol-2", Kirpal Singh, Standard Publishers Distributors, 11th Edition.
2. "Automotive Mechanics", William H Crouse & Donald LAnglin, Tata Mc Graw Hill Publications, 10th Edition.
3. "Automobile Engineering", Rajput, Laxmi Publications.

REFERENCE BOOKS:

1. "Automobile Engineering", R.B Gupta, Satya Prakashan Publications, 6th Edition.
2. "The Motor vehicle", Newton steeds & Garrett, Society of Automotive Engineers, 13th Edition.
3. "Automotive Engineering", G.B.S. Narang, Khanna Publishers, 5th Edition.
4. "Automotive Mechanics", Joseph Heitner, IPC Transport Press Ltd, 2nd Edition.
5. "The Automobile", Harbans Singh Reyat, S. Chand & company Pvt. Ltd., 6th Edition.

Course Code	BASICS OF TOTAL QUALITY MANAGEMENT		L	T	P	C
21A030508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concept of quality, cost of quality, international quality standards.
- To learn the principles of Total quality management, techniques for problem solving.
- To learn about various tools of quality management used in various industrial applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts of Quality and Quality Control Techniques. **(K2)**
CO2: Understand TQM concepts and History and able to use quality tools for problem solving. **(K2)**
CO3: Use TQM techniques and to formulate quality circles to find solutions with team work. **(K2)**
CO4: Apply various TQM Methods to solve problems in industry. **(K3)**
CO5: Analyze various quality problems and contribute towards continuous improvement in the system. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	2	-	2	2	2	-	2	-	-	-	2	-	-
CO5	1	-	-	-	-	2	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Inspection & Quality Control

Statistical Quality Control (SQC) – Techniques - variables and attributes Control charts : $\bar{X}$ - R Charts, P-Chart, C-Chart. Acceptance Sampling – Single and Double sampling Plan - OC Curves. BIS and ISO Standards – Importance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Control charts: $\bar{X}$ - R Charts, P-Chart, C-Chart, single and double sampling plans and BIS&ISO standards. (L1)

UNIT – II (8 Hrs)

TQM – concepts, History-Quality management philosophies-Juran, Deming, Crosby, Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – internal and external customers - TQM tools & techniques- 7 QC tools- 7 New QC tools.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various quality management philosophies, Evaluation of TQM, TQM tools and technologies. (L1)

<u>UNIT – III</u> (10 Hrs)

Problem solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis, Quality circles – organization – team approach.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse Problem solving process, system failure analysis, fault tree analysis, pedigree analysis and concept Quality circles. (L4)

<u>UNIT – IV</u> (10 Hrs)

Quality Function Development (QFD) – elements of QFD –benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Know the procedure for quality function development, bench marking, taguchi analysis. (L1)

<u>UNIT – V</u> (8 Hrs)

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management, Six sigma approach – application of six sigma approach to various industrial situations.

Learning Outcomes: At the end of this unit, students should be able to

- Know the value improvement, supplier teaming and the concept of business process re-engineering, supply chain management and six sigma. (L1)

<u>TEXTBOOKS:</u>

1. “Total Quality Management”, D.R.Kiran, BS Publications, 2016
2. “Total Quality Management”, Bester field, Pearson.

<u>REFERENCE BOOKS:</u>

1. “Quality management”, Howard Giltow, TMH
2. “Quality management”, Evans.
3. “Quality management”, Bedi
4. “Total Quality Management”, Joseph & Susan Berg

5. "Total Quality Management-Toward the Emerging Paradigm", Bounds, Yorks, Adams, Ranney, McGraHill, 1994

Course Code	PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS		L	T	P	C
21A040507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyze cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts and operation of cellular systems. **(K2)**

CO2: Apply the concepts of co-channel interference & Cell splitting to solve engineering problems. **(K3)**

CO3: Compare different Handoffs. **(K4)**

CO4: Compare various types of multiple access techniques. **(K4)**

CO5: Evaluate suitability of a cellular system in real time applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	3

UNIT – I (10 Hrs)

Introduction to Cellular Mobile Systems: Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts and operation of cellular systems. (L2)
- Explain the characteristics of mobile radio environment. (L2)

UNIT – II (8 Hrs)
Cellular Radio System Design: General description of the problem, Concept of frequency reuse channels, Co-channel interference reduction, Desired C/I ratio, Cell splitting and sectoring, Microcell zone concept.

Learning Outcomes: At the end of this unit, students should be able to
- Understand the concept of frequency reuse and co-channel interference in cellular systems. (L2)
- Apply the concept of cellular systems to solve engineering problems. (L3)
- Explain the design problems of cellular systems. (L3)

UNIT – III (10 Hrs)
Handoffs and Dropped Calls: Why handoffs and types of handoffs, Initiation of handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Inter system handoff. Introduction to dropped call rate.

Learning Outcomes: At the end of this unit, students should be able to
- Understand why handoff is required. (L2)
- Apply handoff techniques to solve engineering problems. (L3)
- Compare various types of handoffs. (L4)

UNIT – IV (8 Hrs)
Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

Learning Outcomes: At the end of this unit, students should be able to
- Understand various types of multiple access techniques. (L2)
- Apply the concept of multiple access to solve engineering problems. (L3)
- Compare various types of multiple access techniques. (L4)

UNIT – V (9 Hrs)
Digital Cellular Systems: Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

Learning Outcomes: At the end of this unit, students should be able to
- Understand operation of various types of digital cellular systems. (L2)
- Compare various types of digital cellular systems. (L2)
- Evaluate suitability of a cellular system in real time applications. (L4)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Mobile Cellular Tele communications", William C.Y.Lee, McGraw – Hill International, 2nd Edition, 1995.
2. "Wireless Communications–Principles and Practice", Theodore S. Rappaport, PHI, 2nd Edition, 2004.

REFERENCE BOOKS:

1. "Principles of Modern Wireless Communications Systems –Theory and Practice", Aditya K. Jagannatham, McGraw – Hill International, 2015.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117102062
2. https://www.electronicshub.org/wireless-communication-introduction-types-applications/

Course Code	EMBEDDED SYSTEMS		L	T	P	C
21A040508			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the basics of an embedded system
- To introduce the typical components of an embedded system
- To explain various communication interfaces used in embedded system
- To provide knowledge on the design process of embedded system applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Discuss the basic concepts of an embedded system. **(K3)**

CO2: Explainthe role of system core, memory, sensors, actuators, I/O and other sub system components in an embedded system. **(K3)**

CO3: Explain the different communication interfaces of an embedded system. **(K3)**

CO4: Illustrate about the interrupt service mechanism and device drivers. **(K3)**

CO5: Write aboutvarious steps involved in design and development of embedded firmware. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

Introduction to Embedded Systems: Definition, Embedded systems Vs General computing systems, History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

Learning Outcomes: At the end of this unit, students should be able to

- Classify embedded systems based on generation, complexity and performance. (L2)
- Discuss the characteristics of an embedded system. (L2)
- Explain the design process in embedded system. (L3)

UNIT – II (9 Hrs)

Typical Embedded System: Core of the embedded system, Memory-ROM, RAM, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer, PCB and passive components

Learning Outcomes: At the end of this unit, students should be able to

- Discuss about the core of the embedded system. (L2)
- Summarize different factors to be considered in the selection of memory for an embedded system. (L2)
- Explain the role of sensors, actuators, I/O components and other subsystem components used in embedded system. (L3)

UNIT – III (9 Hrs)

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various types of on-board communication interfaces. (L3)
- Describe the external communication interfaces used in embedded system. (L2)
- Discuss the different types of wireless communication interfaces used in embedded system. (L2)

UNIT – IV (9 Hrs)

Device drivers and Interrupt Service Mechanism: Programmed I/O busy-wait approach without interrupt service mechanism, Interrupt-driven I/O, interrupt service routine concept, interrupt sources, hardware interrupts, software interrupts, interrupt-servicing mechanism, multiple interrupts, interrupt service threads as second-level interrupt handlers, context and the periods for context switching, interrupt latency, interrupt-service deadline, interrupt service mechanism form context-saving angle, Device driver programming.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize pros and cons of interrupt driven data transfer. (L2)
- Illustrate hardware and software interrupts with examples. (L3)
- Know how interrupts can be used to minimize latency. (L3)
- Describe uses of hardware and software assigned priorities in an interrupt service mechanism. (L2)
- Differentiate ISRs & device driver functions. (L2)

<u>UNIT – V</u> (8 Hrs)

Embedded Firmware Design and Development: Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the different approaches for embedded firmware design. (L2)
- Discuss the different embedded firmware development languages. (L2)
- Explain the process of Assembly language to machine language conversion and High-level language to machine language conversion. (L3)
- Write about various steps involved in design and development of embedded firmware. (L3)

<u>TEXTBOOKS:</u>

1. “Introduction to Embedded Systems”, Shibu. K.V., McGraw Hill Education, 2nd Edition, 2017.
2. “Embedded Systems: Architecture, Programming and Design”, Raj Kamal, McGraw Hill Education, 3rd Edition, 2017

<u>REFERENCE BOOKS:</u>

1. “Computers as Components”, Wayne Wolf, Morgan Kaufmann, Elsevier, 2nd Edition
2. “Embedded Systems- An integrated approach”, Lyla B Das, Pearson education, 2012
3. “Embedded Microcomputer Systems Real Time Interfacing”, Jonathan W.Valvano, Cengage Learning, 3rd Edition, 2012.

HONOURS

Course Code	ADVANCED COMPUTER NETWORKS (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN01			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand computer network architectures, protocols, and interfaces.
- The OSI reference model and the Internet architecture network applications.
- Expose students to the concepts of traditional as well as modern day computer networks - wireless and mobile, multimedia-based.
- To understand the key concepts and practices employed in modern computer networking

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Summarize the network performance or network types. **(K2)**
CO2: Illustrate switching, transferring and address classifications of networks. **(K3)**
CO3: Calculate IP addresses and apply link layer protocols. **(K3)**
CO4: Analyze the internet working functionalities. **(K4)**
CO5: Classify application layer functionalities or multimedia applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (12 Hrs)

Network Architecture, Performance: Bandwidth and Latency, High Speed Networks, Network-Centric View, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks, Overlay Networks: Routing Overlays, Peer-to-Peer Networks and Content Distribution Networks, Client-Server Networks, Delay Tolerant Networks

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network performance. (L1)
- Differentiate the different types of networks. (L2)
- Identify the reliable and unreliable networks. (L1)

UNIT – II (12 Hrs)

Switching: Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Message-Switched Networks, Asynchronous Transfer Mode: Evolution, Benefits, Concepts,

Exploring Broadband Integrated Services Digital Network, Layer and Adaptation Layer, IPv4: Address Space, Notations, Classful, Classless, Network Address Translation, Datagram

Learning Outcomes: At the end of this unit, students should be able to

- Describe the switching process over networks. (L1)
- Explain data transmission process. (L1)
- Illustrate IPV4 addresses and classifications. (L3)

UNIT – III (10 Hrs)

Fragmentation and Checksum IPv6 Addresses: Structure, Address Space, Packet Format and Extension Headers, ICMP, IGMP, ARP, RARP, Congestion Control and Resource Allocation: Problem, Issues, Queuing, TCP Congestion Control, Congestion-Avoidance Mechanisms and Quality of Service

Learning Outcomes: At the end of this unit, students should be able to

- Perform fragmentations and error detection or correction approaches. (L3)
- Identify different network layer protocols. (L2)
- Estimate congestion occurrence and avoiding procedures. (L3)

UNIT – IV (8 Hrs)

Internetworking: Intra-Domain and Inter-Domain Routings, Unicast Routing Protocols: RIP, OSPF and BGP, Multicast Routing Protocols: DVMRP, PIM-DM, PIM-SM, CBT, MSDP and MOSPF, Spanning Tree Algorithm, Optical Networking: SONET/SDH Standards, Traffic Engineering: Requirement, Traffic Sizing, Characteristics, Protocols, Time and Delay Considerations, Connectivity, Availability, Reliability and Maintainability and Throughput.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze internetworking and routing process. (L4)
- Classify internetworking protocols. (L4)
- Illustrate optical networking and engineering functionalities. (L3)

UNIT – V (8 Hrs)

Multimedia Over Internet: Transmission, IP Multicasting and VoIP, Domain Name System: Name Space, Domain Name Space, Distribution, Domains, Resolutions and Dynamic Domain Name System, SNMP, Security: IPSec, SSL/TLS, PGP and Firewalls, Datacenter Design and Interconnection Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the multimedia transmission over internet. (L4)
- Illustrate domain name system. (L3)
- Apply security policies over interconnected networks. (L3)

TEXTBOOKS:

1. "Computer Networks: A System Approach", Larry L. Peterson and Bruce S. Davie, 5th Edition, Morgan Kaufmann, Elsevier, 2012.
2. "Data Communications and Networking", Behrouz A. Forouzan, McGraw Hill, 5th Edition, 2017.
3. "Introduction to Computer Networks and Cyber Security", Chwan-Hwa (John) Wu, J. David Irwin, CRC press, Taylor & Francis Group, 2014
4. "Computer Networks", Andrew S. Tanenbaum, David J. Wetherall, Pearson, 5th Edition, 2014.

REFERENCE BOOKS:

1. "Advanced Computer Networking: Concepts and Applications", Satish Jain

Course Code	OBJECT ORIENTED SOFTWARE ENGINEERING (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN02			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To learn and understand various O-O concepts along with their applicability contexts.
- To identify domain objects, their properties, and relationships among them.
- To identify and model/represent domain constraints on the objects and (or) on their relationships
- To learn various modelling techniques to model different perspectives of object-oriented software design (UML)

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the given project in various phases of a software lifecycle. **(K2)**
CO2: Analyze software requirements with use cases. **(K4)**
CO3: Examine the various design and development solutions with proper analysis. **(K3)**
CO4: Design and implement the Software projects. **(K3)**
CO5: Compare various testing methods. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Introduction to Software Engineering - Software Development process models – Agile Development - Project & Process - Project management - Process& Project metrics - Object Oriented concepts, Principles & Methodologies.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of software engineering. (L2)
- Illustrate the various development activities. (L2)

UNIT – II (10 Hrs)

Software Requirements Specification, Software prototyping - Software project planning - Scope - Resources - Software Estimation - Empirical Estimation Models – Planning - Risk Management - Software Project Scheduling - Object Oriented Estimation & Scheduling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand about software requirements specifications. (L2)

- Explain various software resources. (L5)

<u>UNIT – III</u> (11 Hrs)
Analysis Modelling - Data Modelling - Functional Modelling& Information Flow – Behavioural Modelling Structured Analysis - Object Oriented Analysis - Domain Analysis-Object oriented Analysis process - Object Relationship Model - Object Behaviour Model, Design modelling with UML

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various analysis concepts. (L5)
- Design modelling with UML. (L6)

<u>UNIT – IV</u> (10 Hrs)
Design Concepts & Principles - Design Process - Design Concepts - Modular Design - Design Effective Modularity - Introduction to Software Architecture - Data Design - Transform Mapping - Transaction Mapping - Object Oriented Design - System design process- Object design process - Design Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- List the basic design patterns. (L1)
- Describe the object oriented design and system design process. (L2)

<u>UNIT – V</u> (9 Hrs)
Top - Down, Bottom-Up, object oriented product Implementation & Integration. Software Testing methods White Box, Basis Path-Control Structure - Black Box - Unit Testing - Integration testing - Validation & System testing - Testing Tools – Software Maintenance & Reengineering

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate various software testing methods. (L2)
- Illustrate software maintenance and reengineering. (L3)

<u>TEXTBOOKS:</u>

1. “Software Engineering Concepts”, Fairley R, 2nd edition, Tata McGraw Hill, New Delhi, 2003.
2. “An Integrated Approach to Software Engineering”, Jalote P, 3rd edition, Narosa Publishers, New Delhi, 2013.

<u>REFERENCE BOOKS:</u>

1. “The Unified Modeling Language User Guide”, Grady Booch, James Rumbaugh, Ivar Jacobson, Addison Wesley, 1999.

2. "Object Oriented Systems Development", Ali Bahrami, 1st Edition, The McGraw-Hill Company, 1999

Course Code	SERVICE ORIENTED ARCHITECTURE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN03			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand SOA and evolution of SOA.
- To understand web services and primitive, contemporary SOA.
- To understand various service layers.
- To understand service-oriented analysis and design based on guidelines.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the characteristics and issues of SOA. **(K2)**
CO2: Classify and implement various message patterns of SOA. **(K3)**
CO3: Analyze various principles and services of SOA. **(K4)**
CO4: Implement a service using WSDL. **(K3)**
CO5: Design a SOA service for various Business Models. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Introducing SOA: Fundamental SOA, Common Characteristics of Contemporary SOA, Common Tangible Benefits of SOA, Common Pitfalls of Adopting SOA. The Evolution of SOA: An SOA Timeline, The Continuing Evolution of SOA, The Roots of SOA.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the fundamentals of SOA. (L1)
- Understand the advantages and disadvantages of SOA. (L2)

UNIT – II (11 Hrs)

Web Services and Primitive SOA: The Web Services Frame Work, Services, Service Descriptions, Messaging. Web Services and Contemporary SOA (Part I-Activity management and Composition): Message Exchange Patterns, Service Activity, Coordination, Atomic Transactions, Orchestration, and Choreography. Web Services and Contemporary SOA (Part-II-

Advanced Messaging, Metadata and Security): Addressing, Reliable Messaging, Correlation, Policies, Metadata exchange, Security.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various service primitive. (L2)
- Compare primitive and contemporary SOA. (L4)

<u>UNIT – III</u> (11 Hrs)

Principles of Service-Orientation: Service–Orientation and the Enterprise, Anatomy of SOA, Common Principles of Service–Orientation, Interrelation between Principles of Service-Orientation, Service Orientation and Object Orientation, Native Web Services Support for Principles of Service-Orientation. Service Layers: Service-Orientation and Contemporary SOA, Service Layer abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer, Agnostic Services, Service Layer Configuration Scenarios

Learning Outcomes: At the end of this unit, students should be able to

- Examine the Native Web services support for principles of SOA. (L3)
- Analyze various services in various layers of SOA. (L4)

<u>UNIT – IV</u> (12 Hrs)

SOA Delivery Strategies: SOA Delivery Lifecycle Phases, The Top-Down Strategy, The Bottom-up Strategy, The Agile Strategy. Service Oriented Analysis (Part I-Introduction): Introduction to Service Oriented Analysis, Benefits of a Business Centric SOA, Deriving Business Services. Service Oriented Analysis (Part-II-Service Modelling): Service Modelling, Service Modelling Guidelines, Classifying Service Model Logic, Contrasting Service Modelling Approaches. Service Oriented Design (Part I-Introduction): Introduction to Service-Oriented Design, WSDL Related XML Schema Language Basics, WSDL Language Basics, Service Interface Design Tools. Service Oriented Design (Part II-SOA Composition Guidelines): SOA Composing Steps, Considerations for Choosing Service Layers, Considerations for Positioning Core SOA Standards, Considerations for Choosing SOA Extensions.

Learning Outcomes: At the end of this unit, students should be able to

- Deploying a service using WSDL. (L3)

<u>UNIT – V</u> (10 Hrs)

Service Oriented Design (Part III- Service Design): Service Design Overview, Entity- Centric Business Service Design, Application Service Design, Task-Centric Business Service Design, Service Design Guidelines. Service Oriented Design (Part IV-Business Process Design): WS-BPEL Language Basics, WS- Coordination Overview, Service Oriented Business Process Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Web services Designs. (L2)

- Implement a SOA following the design guidelines. (L3)

TEXTBOOKS:

1. "Service-Oriented Architecture-Concepts, Technology and Design", Thomas Erl, Pearson Education, 2006.
2. "Understanding SOA with Web Services", Eric Newcomer, Greg Lomow, Pearson Education, 2005

REFERENCE BOOKS:

1. "Service Oriented Architecture Concepts Technology & Design", Thomas Erl, Pearson Education Limited; 2015, ISBN-13: 9788131714904.
2. "Service Oriented Architecture An Integration Blueprint", Guido Schmutz, Peter Welkenbach, Daniel Liebhart, Shroff Publishers & Distributors; 2010, ISBN-13: 9789350231081

Course Code	ADVANCED OPERATING SYSTEMS (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN04			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To be able to read and understand sample open source programs and header files.
- System calls which explore networking and security applications.
- To acquire the knowledge in the implementation of interprocess communication.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Realize the internals of Unix file system and analyze the functionalities of operating system. **(K3)**

CO2: Examine processes mechanism in operating system. Compare & contrast various system calls. **(K4)**

CO3: Understand the functionality of VFS. Analyze various file system types. **(K4)**

CO4: Realize the internals of windows operating system. Analyze the functionalities of windows operating systems. **(K4)**

CO5: Build mobile applications using Android. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Basic Operating System Concepts - Overview of Unix File System - Files - Links - Types – Inodes -Access Rights - System Calls - Overview of Unix Kernels -Model - Implementation - Reentrant Kernels - Address Space - Synchronization - Interprocess Communication - Process Management - Memory Management - Device Drivers.

Learning Outcomes: At the end of this unit, students should be able to

- Define functionalities of Unix file system. (L1)
- Categorize different kinds of system calls. (L4)

UNIT – II (10 Hrs)

Processes, Lightweight Processes, and Threads - Process Descriptor - State - Identifying a Process - Relationships among processes - Organization - Resource Limits - Creating Processes - System Calls - Kernel Threads - Destroying Processes -Termination - Removal.

Learning Outcomes: At the end of this unit, students should be able to

- Identify various states in process life cycle. (L2)
- Differentiate processes, system calls, kernel threads. (L4)

UNIT – III (10 Hrs)

The Virtual File System (VFS) - Role - File Model -System Calls - Data Structures - Super Block, Inode, File, dentry Objects - dentry Cache - Files Associated with a Process - Filesystem Types - Special Files systems – Filesystem Type Registration – Filesystem Handling - Namespaces - Mounting – Unmounting - Implementation of VFS System Calls

Learning Outcomes: At the end of this unit, students should be able to

- Implement VFS system calls. (L3)
- Distinguish file system types and special file systems. (L3)
- Define functionalities of VFS. (L1)

UNIT – IV (10 Hrs)

Windows Operating system - versions, Concepts and tools, Windows internals, System Architecture, Requirements and design goals, Operating system model, Architecture overview. Key system components. System mechanisms - Trap dispatching, object manager, Synchronization, System worker threads, Windows global flags, Local procedural calls, Kernel event tracing.

Learning Outcomes: At the end of this unit, students should be able to

- Define functionalities of windows operating system. (L1)
- Differentiate various system mechanisms. (L4)

UNIT – V (10 Hrs)

What is android, basic building blocks – activities, services, broadcast receivers & content, ui components views & notifications, components for communication -intents & intent filters, android api levels launching emulator editing emulator settings emulator shortcuts log cat usage, Applications of Android

Learning Outcomes: At the end of this unit, students should be able to

- Develop various applications using Android. (L6)
- Identify building blocks of Android. (L2)

TEXTBOOKS:

1. "Understanding the Linux Kernel", Daniel P. Bovet and Marco Cesati, 3rd Edition, O'Reilly Publications, 2005.
2. “Structure and Interpretation of Computer Programs”, Harold Abelson, Gerald Jay Sussman and Julie Sussman, 2nd Edition, Universities Press, 2013.

REFERENCE BOOKS:

1. "Microsoft Windows Internals", Mark E. Russinovich and David A. Solomon, 4th Edition, Microsoft Press, 2004

CSE - ARTIFICIAL INTELLIGENCE & ARTIFICIAL INTELLIGENCE AND MACHINE LEARNNG

(For the batches admitted from the academic year 2021-22)

Vision

- To be a recognized Centre in the field of Computer Science and Engineering by imparting quality education and also equipping the students with latest technologies, soft skills and ethical values to face the challenges in industry & society.

Mission

- To provide quality education by imparting state of the art facility in Computer Science and Engineering.
- Enrich the students with innovative and problem-solving skills by establishing continuous Industry Institute interaction.
- To prepare the learners possessing social commitment and ethical values to face the dynamic challenges of industry and society.

Institutional Objectives

- To create a conducive and competitive environment for students through curricular and extra-curricular activities.
- Promote the culture of research among the faculty.
- To promote synergetic alliances with premier Institutions, Industry, CSIR laboratories and various Government organizations for Collaborative Research Projects.
- To promote economic and social enrichment of the society through Skill Development programmes, Entrepreneurship and extension activities.
- To introduce demand-driven new UG&PG academic programmes.
- To ensure a high degree of quality in terms of providing infrastructure, research ambience, faculty and staff development.

Core Values

- *Thirst for Quality Education:* The stake holders of the institute particularly management, employees and students of the institution have a consistent thirst for quality improvement of the processes and services in the institution.
- *Lifelong Learning:* In the fast-changing technological world, acquiring a special skill at one point of time will not be enough for ever long survival. Hence to

flourish in the work place and to bring in innovations in the ways of doing, employee, student as well as alumni must be continuous learners and tech savvy.

- *Diversity and Participation:* PBRVITS promotes the involvement of faculty, staff and students from all social, economic, ethnics, cultural and religious backgrounds to get the synergy of combining the diversified agents. The focus is on involving students to exhibit their talent in various curricular and co-curricular activities and strengthening alumni link to share their experiences to the students.
- *Academic Integrity and Accountability:* Management induces accountability in the employees for the career of the students and the academic leadership establishes a mentoring mechanism for realization of responsibilities of students towards their parents and in turn to the society.

CSE - ARTIFICIAL INTELLIGENCE & ARTIFICIAL INTELLIGENCE AND MACHINE LEARNNG

(For the batches admitted from the academic year 2021-22)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept./Branch & Innovations

Semester I (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110101	Calculus and Special Functions	3	0	0	3	30	70	100
2	BS	21A110105	Applied Chemistry	3	0	0	3	30	70	100
3	ES	21A050302	C-Programming & Data Structures	3	0	0	3	30	70	100
4	BS	21A110106	Engineering Physics	3	0	0	3	30	70	100
5	HSMC	21A110202	English for Professionals	2	0	0	2	30	70	100
6	ES	21A050301	Engineering & IT Workshop	0	0	3	1.5	30	70	100
7	BS	21A110109A	Engineering Physics Lab	0	0	3	1.5	30	70	100
8	BS	21A110108B	Applied Chemistry Lab	0	0	3	1.5	30	70	100
9	ES	21A050303	C-Programming & Data Structures Lab	0	0	3	1.5	30	70	100
Total							**20**			**900**

Semester II (First year)

S. No	Category	Course Code	Course Title	Hours per week L	T	P	Credits C	CIE	SEE	Total
1	BS	21A110102	Mathematical Methods	3	0	0	3	30	70	100
2	BS	21A110110	Probability and Statistics	3	0	0	3	30	70	100
3	ES	21A030301	Engineering Drawing	1	0	4	3	30	70	100
4	ES	21A050304	Advanced Data Structures through C++	3	0	0	3	30	70	100
5	ES	21A020303	Basic Electrical and Electronics Engineering	3	0	0	3	30	70	100
6	HSMC	21A110201	Communicative English Lab	0	0	2	1	30	70	100
7	ES	21A020304	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
8	ES	21A050305	Advanced Data Structures through C++ Lab	0	0	3	1.5	30	70	100
9	MC	21A000005	Biology for Engineers	2	0	0	0	30	--	--
Total							**19**			**800**

Semester III (Second year)

S. No	Category	Course Code	Course Title	Hours per week L	T	P	Credits C	CIE	SEE	Total
1	BS	21A110111	Mathematical Foundations of Computer Science	3	0	0	3	30	70	100
2	PC	21A050401	Digital Logic Design & Computer Organization	3	0	0	3	30	70	100
3	PC	21A050402	Database Management Systems	3	0	0	3	30	70	100
4	PC	21A050403	Object Oriented Programming through Java	3	0	0	3	30	70	100
5	ES	21A050306	Python Programming & Data Science	3	0	0	3	30	70	100
6	PC	21A050404	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC	21A050405	Object Oriented Programming through JavaLab	0	0	3	1.5	30	70	100
8	ES	21A050307	Python Programming & Data Science Lab	0	0	3	1.5	30	70	100
9	SC	21A310701	MATLAB Programming	1	0	2	2	30	70	100
10	MC	21A000002	Constitution of India	2	0	0	0	30	0	0
Total							**21.5**			**900**

Semester IV (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A310402	Artificial Intelligence & Neural Networks	3	0	0	3	30	70	100
2	PC	21A050407	Software Engineering & OOAD	3	0	0	3	30	70	100
3	PC	21A050408	Computer Networks	3	0	0	3	30	70	100
4	PC	21A050409	Operating Systems	3	0	0	3	30	70	100
5	HSMC	21A110203	Managerial Economics and Financial Analysis	3	0	0	3	30	70	100
6	PC	21A310404	Artificial Intelligence & Neural Networks Lab	0	0	3	1.5	30	70	100
7	PC	21A050411	Software Engineering & OOAD Lab	0	0	3	1.5	30	70	100
8	PC	21A050412	Computer Networks & Operating Systems Lab	0	0	3	1.5	30	70	100
9	SC	21A050703	Advanced Java	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship-I (Community Service Project) during semester break										

Semester V (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050413	Theory of Computation	3	0	0	3	30	70	100
2	PC	21A050414	Software Testing	3	0	0	3	30	70	100
3	PC	21A050430	Machine Learning	3	0	0	3	30	70	100
4	OE-I		**Open Elective – I**	3	0	0	3	30	70	100
5	PE-I	21A050416 21A050425 21A050418	**Professional Elective – I** a) Information Retrieval Systems b) Software Project Management c) Mobile Computing	3	0	0	3	30	70	100
6	PC	21A050419	Software Testing Lab	0	0	3	1.5	30	70	100
7	PC	21A310405	Machine Learning Lab	0	0	3	1.5	30	70	100
8	SC	21A310702	R Programming	1	0	2	2	30	70	100
9	MC	21A000003	Universal Human Values	3	0	0	3	30	70	100
10	PROJ	21A310601	Internship – I Evaluation	-	-	-	1.5	-	-	100
Total							**24.5**			**1000**

Semester VI (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050432	Deep Learning	3	0	0	3	30	70	100
2	PC	21A050422	Mobile Application Development	3	0	0	3	30	70	100
3	PC	21A050423	Cloud Computing	3	0	0	3	30	70	100
4	PE-II	21A050417 21A310406 21A310407	**Professional Elective -II** a) SAP b) Cryptography & Network Security c) Basics of Internet of Things	3	0	0	3	30	70	100
5	OE-II		**Open Elective - II**	3	0	0	3	30	70	100
6	PC	21A310408	Deep Learning Lab	0	0	3	1.5	30	70	100
7	PC	21A050427	Mobile Application Development Lab	0	0	3	1.5	30	70	100
8	PC	21A050429	Cloud Computing Lab	0	0	3	1.5	30	70	100
9	SC	21A050705	Programming in C#	1	0	2	2	30	70	100
10	MC	21A000004	Research Methodology	2	0	0	0	30	---	---
Total							**21.5**			**900**
Internship-II (Industry) during semester break										

Semester VII (Fourth year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PE-III	21A050435 21A050431 21A310409	**Professional Elective -III** a) Design Patterns b) Big-Data Analytics using Hadoop c) AI & Applications	3	0	0	3	30	70	100
2	PE-IV	21A310410 21A310411 21A310412	**Professional Elective-IV** a) Predictive Analysis b) Bio Informatics c) Business Intelligence	3	0	0	3	30	70	100
3	PE-V	21A050436 21A310413 21A310414	**Professional Elective -V** a) Block Chain Technology b) Real Time Systems c) Expert Systems	3	0	0	3	30	70	100
4	OE-III		**Open Elective - III**	3	0	0	3	30	70	100
5	OE-IV		**Open Elective - IV**	3	0	0	3	30	70	100
6	HSMC	21A110204	Management Science	3	0	0	3	30	70	100
7	SC	21A050706	Hacking Tools	1	0	2	2	30	70	100
8	PROJ	21A310602	Internship-II Evaluation	-	-	-	3	--	--	100
Total							**23**			**800**

Semester VIII (Fourth Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PROJ	21A310603	Full Internship & Major Project	-	-	12	10	110	140	250
2	PROJ	21A310604	Technical Seminar	-	-	4	2	50	-	50
Total							**12**			**300**

Open Elective – I

S. No	Course Code	Course Title
1	21A010501	Air Pollution and Control
2	21A020501	Electric Vehicles
3	21A020502	Electrical Distribution Systems
4	21A030501	Robotics
5	21A030502	Basics of Mechanical Engineering
6	21A040501	Integrated Circuits and Applications
7	21A040502	Introduction to Signal Processing

Open Elective – II

S. No	Course Code	Course Title
1	21A010502	Environmental Pollution and Control
2	21A020503	Smart Grid
3	21A020504	Energy Storage Systems
4	21A030503	Automation in Industries
5	21A030504	Rapid Prototyping
6	21A040503	Principles of Communication Systems
7	21A040504	Electronic Instrumentation

Open Elective – III

S. No	Course Code	Course Title
1	21A010503	Disaster Management and Mitigation
2	21A020505	Renewable Energy Systems
3	21A020506	Concepts of Electrical Drives and Applications
4	21A030505	Optimization Techniques
5	21A030506	Global Warming and Climate Changes
6	21A040505	Electronic Sensors
7	21A040506	Introduction to Image Processing

Open Elective – IV

S. No	Course Code	Course Title
1	21A010504	Cost Effective Housing Techniques
2	21A020507	Energy Conservation and Management
3	21A020508	Basics of Power Electronics
4	21A030507	Basics of Automotive Engineering
5	21A030508	Basics of Total Quality Management
6	21A040507	Principles of Cellular and Mobile Communications
7	21A040508	Embedded Systems

COURSES OFFERED FOR HONOURS DEGREE IN CSE-AI/AIML

S. No	Course Code	Course Title	Hours per week		Credits	CIE	SEE	Total
			L	T	C			
1	21A05HN01	Advanced Computer Networks	3	1	4	30	70	100
2	21A05HN02	Object Oriented Software Engineering	3	1	4	30	70	100
3	21A05HN03	Service Oriented Architecture	3	1	4	30	70	100
4	21A05HN04	Advanced Operating Systems	3	1	4	30	70	100
5	21A05HN05	MOOC – 1	-	-	2	-	-	-
6	21A05HN06	MOOC – 2	-	-	2	-	-	-

LIST OF MINORS OFFERED TO CSE-AI/AIML

S. No	Course Code	Course Title	Department offering the course
1	21A040402	Pulse and Digital Circuits	ECE
2	21A040415	Data Communication and Networking	ECE
3	21A040433	Biomedical Signal Processing	ECE
4	21A040434	Radar Engineering	ECE

Course Code	CALCULUS AND SPECIAL FUNCTIONS		L	T	P	C
21A110101	(Common to all branches)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course will illuminate the students in the concepts of calculus and Mean value theorems.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Utilize mean value theorems to real life problems.
CO2: Familiarize with functions of several variables which is useful in optimization.
CO3: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems.
CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 3- dimensional coordinate systems.
CO5: Utilize special functions in evaluating definite integrals.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (10 Hrs)

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT – II (12 Hrs)

Multi variable calculus: Partial derivatives, total derivatives, chain rule, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes: At the end of this unit, students should be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

UNIT – III (10 Hrs)

Double Integrals: Evaluation of Double integrals, change of order of integration, change of variables. Areas using Double Integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

UNIT – IV (10 Hrs)

Triple Integrals: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volumes using triple integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate triple integrals in Cartesian, cylindrical and spherical polar coordinates. (L5)
- Apply triple integration techniques in evaluating volumes. (L4)

UNIT – V (12 Hrs)

Beta and Gamma functions: Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

TEXTBOOKS:

1. "Higher Engineering Mathematics", S. Grewal, Khanna Publishers, 44/e, 2017.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.

REFERENCE BOOKS:

1. “Advanced Engineering Mathematics”, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.
2. “Calculus”, George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
3. “Advanced Modern Engineering Mathematics”, Glyn James, Pearson publishers, 4/e, 2011.
4. “Advanced Engineering Mathematics”, Michael Greenberg, Pearson Education, 9th Edition.
5. “Advanced Engineering Mathematics with MATLAB”, Dean G. Duffy, CRC Press
6. “Advanced Engineering Mathematics”, Peter O’Neil, Cengage Learning.
7. “Engineering Mathematics Volumes-I &II”, R.L. Garg Nishu Gupta, Pearson Education
8. “Higher Engineering Mathematics”, B. V. Ramana, McGraw Hill Education
9. “Higher Engineering Mathematics”, H. K. Das, Er. Rajnish Verma, S. Chand & Co. Ltd.
10. “Advanced Engineering Mathematics”, N. Bali, M. Goyal, C. Watkins, Infinity Science Press.
11. “Engineering Mathematics”, T.K.V Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications.

Course Code	APPLIED CHEMISTRY (Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110105			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To familiarize Applied chemistry and applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods and applications.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the salient features of different theories along with their applications.
CO2: Discuss about the model engineering materials.
CO3: Apply the knowledge of various electrodes for the development of new batteries.
CO4: Identify the different polymers and their uses in various fields of engineering.
CO5: Analyze the knowledge of different analytical techniques used in engineering and also development of new techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	-

UNIT-I (14 Hrs)

Structure and Bonding Models: Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, Molecular orbital theory –bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, π-molecular orbital's of butadiene and benzene, calculation of bond order. Crystal field theory–salient features–splitting in octahedral and tetrahedral geometry.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Discuss the basic concept of molecular orbital theory (L3)
- Explain the calculation of bond order of O_2 and CO molecules (L2)
- Discuss the salient features of Crystal field theory (L3)

UNIT-II (10 Hrs)

Modern Engineering Materials: Band theory of solids- band diagrams for conductors, Insulators, Semiconductors, Effect of doping on band structures.

Super conductors and Super capacitors: Introduction, Definition, Classification, Applications.

Nano chemistry: Introduction, classification of nano materials, properties and applications of Fullerenes, carbon nanotubes and Graphene nanoparticles.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nanotubes and Graphenes nanoparticles (L2).

UNIT-III (13 Hrs)

Electro Chemistry and Applications: Electrodes and their concepts, Types of Reference electrodes-their applications. Electrochemical cell, Nernst equation, Numerical problems on emf.

Primary cells – Zinc-air battery, Secondary cells – Lead-acid and Lithium-ion batteries-working of the batteries including cell reactions; Fuel cells- hydrogen-oxygen, methanol- oxygen fuel cells – working of the cells.

Potentiometry- principle, potentiometric titrations (redox titrations), Conductometry-conductometric titrations (acid-base titrations).

Electrochemical sensors– potentiometric sensors principle with examples, ampere metric sensors principle with examples and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)

UNIT-IV (13 Hrs)

Polymer Chemistry: Introduction to polymers, functionality of monomers and their significance, Tacticity of polymers, Types of polymerization- chain growth, step growth and copolymerization with specific examples and mechanisms of polymer formation.

Plastomers-Thermoplastics and Thermo setting plastics, Preparation, properties and applications of– PVC, Teflon, Bakelite, Nylons.

Elastomers – Buna-S, Buna-N– preparation, properties and applications of Buna-S, Buna-N.

Conducting polymers, examples, classification, polyacetylene, polyaniline - mechanism of conduction and applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylons (L2)

- Describe the mechanism of conduction in conducting polymers (L2)
- Discuss Buna-S and Buna-N and their applications (L2)

UNIT-V (10 Hrs)

Instrumental Methods and Applications: Introduction, Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law- Principle, instrumentation and applications of UV-Visible**,** IR-Spectroscopy's and pH-metry, Solid-Liquid Chromatography–TLC, retention factor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles and applications of different analytical instruments (L2)

TEXTBOOKS:

1. "Engineering Chemistry", Jain and Jain, Dhanpat Rai publications, 17/e, 2018
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014
3. "Principles of Instrumental Analysis", Skoog, FJ Holler and SR Crouch, 7/e, 2018
4. "Applied Chemistry", Guesser, Springer's Publications, 2001
5. "Atkins' Physical Chemistry", Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 10/e, 2010

REFERENCE BOOKS:

1. "Concise Inorganic Chemistry", J. D. Lee, Oxford University Press, 5/e, 2008
2. "Engineering Chemistry", G. V. Subba Reddy, K. N. Jayaveera and Ramachandraiah, McGraw Hill, 2020.

<table>
<tr><th>Course Code</th><th rowspan="2">C-PROGRAMMING & DATA STRUCTURES
(Common to all branches)</th><th colspan="2">L</th><th>T</th><th>P</th><th>C</th></tr>
<tr><td>21A050302</td><td colspan="2">3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">I</td></tr>
</table>

COURSE OBJECTIVES:

- Introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- Demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C using Arrays and Strings.
CO3: Modularize the problem and also solution.
CO4: Design applications in C using Functions, Pointers, and Structures.
CO5: Explore various operations on Stacks, Queues and Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Computer Fundamentals, Algorithm, Flowchart.

Introduction to C Language: Characteristics, Identifiers, Constants, Data types, Keywords, Basic input/output statements, Structure of a C program.

Operators and Expressions: Operators classification, Assignment Operator, Arithmetic Operators, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators with examples – Operator precedence and Associativity, Type casting.

Statements: Simple and Compound statements, Control Statements - Conditional/Decision statements, Loop Control Statements, Branch Control statements.

Learning Outcomes: At the end of this unit, students should be able to

- Solve complex problems using language independent notations (L3)
- Use C basic concepts to write simple C programs (L3)
- Test and execute the programs and correct syntax and logical errors (L4)
- Select the control structure for solving the problem (L4)
- Implement conditional branching, iterations (L2)

UNIT-II (12 Hrs)

Arrays: Declarations, Initialization and accessing elements, Single, Two and Multi-dimensional arrays.

Array Techniques: Array order reversal, finding the maximum and minimum number in a set, sorting the given array elements.

Strings: String I/O functions, String handling functions, Data conversion functions.

Learning Outcomes: At the end of this unit, students should be able to

- Use arrays to process multiple homogeneous data (L3)
- Solve mathematical problems using C Programming languages (L3)
- Apply string handling functions (L3)

UNIT-III (12 Hrs)

Functions: Types of functions, Library functions, User-defined functions, Function Categories, Nested functions, Recursion, Symbolic constants, Pre-processor Commands, Storage classes – auto, register, static, extern, Type qualifiers.

Input and output: Standard input and output, Non-formatted Input and Output statements, Formatted Input and Output statements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of modular programming (L2)
- Apply modular approach for solving the problem (L3)
- Writing C programs using various storage classes to control variable access (L5)
- Apply input and output statements to process the data in various formats (L3)

UNIT-IV (12 Hrs)

Pointers: Pointers and addresses, Passing parameters to functions, Address Arithmetic operations, Void and Null pointers, Pointer and Arrays, Pointer and Strings, Array of Pointers, Pointer and Functions, Pointer-to-Pointer, Dynamic Memory Allocation. Uses of Pointers, Command line Arguments.

Structure and Union: Declaration and Initialization of a structure, Copy and comparisons, Array of structures, Structure with pointer, Nested structures, Type Definition, Enumeration, Union.

Learning Outcomes: At the end of this unit, students should be able to

- Structure the individual data elements to simplify the solutions (L6)
- Facilitate efficient memory utilization (L6)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT-V (14 Hrs)

Data Structures: Overview of data structures, **Stack:** Representation of a stack, Operations and Applications of a Stack – Evaluation of Arithmetic Expressions, Implementation of Recursion – **Queue:** Representation of a queue, Operations and Applications of a Queue – CPU Scheduling in Multi-programming Environment.

Linked List: Representations of linked lists, singly linked list, doubly linked list, Circular linked list and its operations.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the operations of a stack (L2)
- Develop various operations on Queues (L6)
- Analyze various operations on singly linked list (L4)
- Interpret operations of doubly linked lists (L2)
- Apply various operations on Circular linked lists (L6)

TEXTBOOKS:

1. “The Complete Reference C”, Herbert Schildt, McGraw Hill Education, Fourth Edition
2. “Programming in C and Data Structures”, J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
3. “Fundamentals of Data Structures in C”, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition

REFERENCE BOOKS:

1. “The C Programming Language”, Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition
2. “C and Data Structures”, E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
3. “Programming in C”, Pradip Dey and Manas Ghosh, Oxford University Press, 2018.
4. “Schaum’s Outline of Data Structures”, Seymour Lipschutz, McGraw Hill, Revised First Edition.

Course Code	**ENGINEERING PHYSICS** (Common to CE, ME, CSE-IOT, CSE-AI, AIML)		**L**	**T**	**P**	**C**
21A110106			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To present the basic concepts needed to understand the crystal structure of materials, X- ray diffraction and the importance of nano materials.
- To understand the mechanisms of lasers and propagation of light through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To explain the significance of acoustics and ultrasound in different engineering fields.
- Evolution of band theory to distinguish materials and explain the properties of semiconductors.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the important properties of crystals & structure determination using X-ray Diffraction along with the nano materials.

CO2: Identify the importance of lasers and fiber optics in different engineering fields

CO3: Understands the response of dielectric & magnetic materials to the applied electric & magnetic fields

CO4: Explain the basic concepts of acoustics and ultrasonics.

CO5: Elaborate the physical properties of semiconductors.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Crystallography & Nano materials

Crystallography: Introduction – Space lattice – Unit cell – Lattice parameters – Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Laue Method - Powder method.

Nano materials – Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball

Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

Learning Outcomes: At the end of this unit, students should be able to

- Classify various crystal systems (L2)
- Identify different planes in the crystal structure (L3)
- Analyze the crystalline structure by Bragg's law to measure the crystallinity of a solid by powder method (L4)
- Identify the nano size dependent properties of nano materials (L2)
- Illustrate the methods for the synthesis and characterization of nano materials (L2)

<u>UNIT - II</u> (12 Hrs)

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Transmission of signals in step index and graded index fibers – Propagation Losses (qualitative) – Applications of fiber in medical field .

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

<u>UNIT – III</u> (12 Hrs)

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius - Mosotti relation in dielectrics (L2)

- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
- Explain the applications of dielectric and magnetic materials (L2)

UNIT - IV **(13 Hrs)**

Acoustics and Ultrasonics

Acoustics- Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine's formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

Ultrasonics- Introduction – Properties – Production by magneto striction and piezoelectric methods – Detection – Acoustic grating – Non Destructive Testing – Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain how sound is propagated in buildings (L2)
- Analyze acoustic properties of typically used materials in buildings (L4)
- Recognize sound level disruptors and their use in architectural acoustics (L2)
- Identify the use of ultrasonics in different fields (L3)

UNIT - V **(13 Hrs)**

Semiconductors- Origin of energy bands - Classification of solids into conductors, semiconductors and insulators -Intrinsic and extrinsic semiconductors (Qualitative treatment)– Density of carriers and Fermi levels in intrinsic & extrinsic semiconductors Drift & diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)

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TEXTBOOKS:

1. "Engineering Physics", Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, S. Chand and Company
2. "Engineering Physics", B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. "Engineering Physics", K. Thyagarajan, McGraw Hill Publishers

REFERENCE BOOKS:

1. "Engineering Physics", Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018

2. "Engineering Physics", Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
3. "Semiconductor physics and devices - Basic principles", Donald A, Neamen, McGraw Hill
4. "Engineering physics", P.K. Palanisamy, SCITECH Publications
5. "Applied Physics", S. Mani Naidu, Pearson Publications
6. "Lasers and Non-Linear Optics", B.B Laud, New Age International Publishers.

Course Code	**ENGLISH FOR PROFESSIONALS**		**L**	**T**	**P**	**C**
21A110202	(Common to all branches)		**2**	**0**	**0**	**2**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To improve Reading and Writing proficiency of students in English with an emphasis on Vocabulary development.
- To provide knowledge of grammatical structures and encourage their appropriate use in writing.
- To improve students' comprehension skills required for academic and professional needs.
- To equip students with writing skills required for professional correspondence in different contexts.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Demonstrate word knowledge and its usage in appropriate contexts.
CO2: Recognize and incorporate basic grammar mechanics and sentence variety in writing.
CO3: Improve comprehension skills through intensive and extensive reading practice.
CO4: Learn and apply various writing formats for effective communication.
CO5: Improve writing skills needed for professional correspondence in various contexts.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

UNIT-I (10 Hrs)

Vocabulary Building: Introduction to affixes and base words, Prefixes and suffixes, Basic comparing and contrasting, Idioms and Phrases, One word substitutes, Words often confused, Synonyms and Antonyms used in the everyday contexts, Using prior knowledge to determine the correct word for the context, Discovering the correct word in the sentence by looking at the surrounding words, Vocabulary in social interactions.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize word parts: affixes, prefixes, suffixes and base words. (L2)
- Use words appropriately in a context. (L3)
- Guess the meanings of the words by using the contextual clues. (L2)
- Use synonyms, antonyms, phrases and idioms in writing. (L2)

UNIT-II (10 Hrs)

Essentials of Sentence Formation: Basic Sentence Structure, word order, Subject-Verb Concord, Using Tenses, Punctuation Marks, Correction of Common Errors

Learning Outcomes: At the end of this unit, students should be able to

- Frame a sentence without any grammatical errors. (L3)
- Use appropriate punctuation marks. (L3)
- Identify common errors in a sentence. (L2)

UNIT-III (10 Hrs)

Reading Comprehension: Understanding short real-world notices, messages, factual material - Scanning, skimming - Inferring meaning - Critical reading - Reading and information transfer

Learning Outcomes: At the end of this unit, students should be able to

- Use skimming and scanning strategies while reading. (L3)
- Infer meaning from the given text. (L3)
- Distinguish between the main idea and supporting ideas. (L3)
- Critically analyse the given text. (L4)

UNIT-IV (10 Hrs)

Writing Skills: Rules for good writing and composition; Paragraph Writing: Structure of a paragraph, Types of paragraphs, Usage of Cohesive Devices; Essay writing: Structure of an Essay, Types of Essays; Letter Writing (Formal and informal): Format and Structure; and Email writing

Learning Outcomes: At the end of this unit, students should be able to

- Learn to organize thoughts into meaningful paragraphs. (L2)
- Use cohesive devices in making the piece of writing more coherent. (L3)
- Compose essays on different topics in a more organised structure. (L3)
- Draft letter and emails in a definite format. (L3)

UNIT-V (10 Hrs)

Professional Correspondence: Internal Correspondences – Memorandum, Note Taking, Minutes of Meetings; External Correspondences - Business Letters - Cover Letters - Sale Letters - Inquiry Letters - Complaint Letters - Emails & Netiquette

Learning Outcomes: At the end of this unit, students should be able to

- Draft official e-mails and letters for different professional purposes. (L3)
- Write proficiently memos and minutes of meeting. (L3)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://digital.library.upenn.edu/women/sultana/dream/dream.html
2. https://owl.purdue.edu/
3. https://www.thesaurus.com/
4. https://www.readwritethink.org/classroom-resources/student-interactives
5. https://www.fluentu.com/blog/english/english-writing-websites/

Course Code	ENGINEERING & IT WORKSHOP LAB		L	T	P	C
21A050301	(Common to all branches)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	I			

PART-A (ENGINEERING WORKSHOP)

COURSE OBJECTIVES:

- To familiarize the students with wood working, sheet metal operations, fitting and electrical house, Wiring and foundry skills.
- To provide technical training to the students on Word, Excel and Presentation.
- To make the students know about the internal parts of a computer.
- To learn how to use Internet facility for Browsing and Searching.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Apply wood working skills and build different parts with metal sheets in real world applications.

CO2: Apply fitting operations in various applications and Preparation of moulds and castings.

CO3: Apply different types of basic electric circuit connections.

CO4: Prepare documentation, spread sheets for calculations and slides for Presentation.

CO5: Identify Computer peripherals and its functions, Internet browsing to obtain the required information

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	1	-
CO2	3	2	2	-	-	2	-	-	-	-	-	2	1	-
CO3	3	2	-	-	-	2	-	-	-	-	-	2	1	2
CO4	3	-	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

LIST OF TOPICS:

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint b) Dovetail joint or Bridle joint

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Square fit.

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections
a) Parallel and series b) Two-way switch c) Godown lighting

Foundry:

a) Preparation of mould cavity using single piece pattern.
b) Preparation of mould cavity using split piece pattern

PART-B (IT WORKSHOP)

LIST OF TOPICS:

Task 1:

MS-Word: Students should be able to create documents using the word processor tool. Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit report.

Task 2:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 3:

Presentations: creating, opening, saving the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, running the slide show.

Task 4: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 5:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.

REFERENCE BOOKS:

1. "Workshop Practice Manual", K. Venkata Reddy, BS Publications.
2. "Engineering work shop practice for JNTU", V. Ramesh babu, VRB Publishers Pvt. Ltd., 2009.
3. "Work shop manual", P. Kannaiah, K. L. Narayana, SCITECH Publishers.
4. "Engineering practices lab manual", Jeyapoovan, Saravanapandian, Vikas Publishing House, 4/E
5. "Dictionary of mechanical engineering", GHF Nayler, Jaico Publishing House.
6. "Introduction to Computers", Peter Norton, McGraw Hill
7. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox.
8. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
9. "Networking your computers and devices", Rusen, Prentice Hall of India
10. "Bigelow's Trouble shooting, Maintaining & Repairing PCs", Bigelow, Tata McGraw Hill Edition

<table>
<tr><td>Course Code</td><td colspan="2">ENGINEERING PHYSICS LAB</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A110109A</td><td colspan="2">(Common to CE, ME, CSE-IOT, CSE-AI, AIML)</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">I</td></tr>
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COURSE OBJECTIVES:

- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its application in finding the wavelength.
- Understands the concepts of interference, diffraction and their applications.
- Verify the Laws of Stretched Strings by sonometer.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Operate various optical instruments

CO2: Estimate wavelength of laser using laser

CO3: Evaluate the acceptance angle of an optical fiber and numerical aperture

CO4: Plot the intensity of the magnetic field of circular coil carrying current with distance

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	-

LIST OF EXPERIMENTS

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of wavelength of LASER light using diffraction grating.
5. Determination of numerical aperture and acceptance angle of a given optical fiber
6. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
7. Sonometer: Verification of the three laws of stretched strings
8. Determination of particle size using LASER.
9. Study the variation of B versus H by magnetizing the magnetic material. (B-H curve)
10. Determination of rigidity modulus of material of a wire -dynamic method. (Torsional Pendulum)

REFERENCE BOOKS:

1. "A Textbook of Practical Physics", S. Balasubramanian, M.N. Srinivasan, S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Code	APPLIED CHEMISTRY LAB		L	T	P	C
21A110108B	(Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of Chemistry
- To verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Distinguish different types of titrations in the volumetric analysis
CO2: Determine the cell constant and conductance of solutions
CO3: Measure the strength of an acid present in secondary batteries
CO4: Analyze the effect of absorbance of given sample solution on concentration by using colorimetry.
CO5: Prepare advanced polymer Bakelite materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-		-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Preparation of Standard Oxalic acid solution
2. Determination of Strength of an acid in Lead- Acid battery
3. Estimation of Ferrous Iron by Dichrometry
4. Potentiometry - Determination of redox potentials and emfs
5. Conductometry - Determination of cell constant and conductance of solutions.
6. Conductometric titration of a) strong acid vs strong base b) weak acid vs strong base.
7. pH-metric titration of a) strong acid vs strong base b) weak acid vs strong base.
8. Verification of the Beer-Lambert's Law and determination of strength of the given unknown solution.
9. Determination of the Retention factor of the sample by Thin Layer Chromatography (TLC).
10. Measurement of 10Dq by spectrophotometric method.
11. Preparation of Bakelite and measurement of its mechanical properties (strength)
12. Preparation of nanomaterials.

TEXTBOOKS:

1. "A Text Book on Experiments and Calculations in Engineering Chemistry", S. Chand Publications, 9/e, 2003.
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014.
3. "Experiments in Applied Chemistry", Dr. Sunita Rattan, S. K. Kataria & Sons Publishers of Engineering, 2/e, 2004.

REFERENCE BOOKS:

1. "Vogel's Text Book of Quantitative Chemical Analysis", Mendham J et.al, Pearson Education, 6/e, 2012.

Course Code	C-PROGRAMMING & DATA STRUCTURES LAB (Common to all branches)		L	T	P	C
21A050303			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of C Programming
- To make the student solve problems, implement algorithms using C language
- To design programs using arrays, strings, pointers and structures
- To design Stack and Queue operations
- To apply different operations on linked lists

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Demonstrate the basic concepts of C programming language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs using functions, arrays, structures and pointers.
CO4: Illustrate the concepts Stacks and Queues.
CO5: Design operations on Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

Week 1

a) Write a C program to swap the given two integer values without using temporary variable.
b) Write a C program to print the first ‘N’ Fibonacci sequence numbers.

Week 2

a) Write a C program to print reverse of a given integer value.
b) Write a C program to find the roots of a quadratic equation.

Week 3

Write a C program that use recursive functions.

i) GCD of given two values.
ii) Factorial of a given value.

Week 4

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program to perform the following:

i) Addition of Two matrices ii) Multiplication of Two matrices

Week 5

a) Write a C program that displays the position or index in the string S where the string T begins or -1 if S doesn't contain T.

b) Write a C program to read a set of strings and sort them in alphabetical order.

Week 6

a) Write a C program to count number of alphabets, digits and special symbols of a given line.

b) Write a C program to check whether a given string is palindrome or not.

Week 7

Write a C program to demonstrate the difference between call-by-value and call-by-address mechanisms.

Week 8

Write a program to perform the operations addition, subtraction, multiplication of complex numbers.

Week 9

Write a C program that implement stack operations using arrays.

Week 10

a) Write a C program that implement linear queue operations using arrays.

b) Write a C program that implement circular queue operations using arrays.

Week 11

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on doubly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following operations on circular linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

TEXTBOOKS:

1. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
2. "Computer Science: A Structured Programming Approach Using C", B.A. Forouzon and R.F. Gilberg, CENGAGE Learning, Third Edition, 2016.
3. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition,
2. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.

Course Code	MATHEMATICAL METHODS (Common to all branches)		L	T	P	C
21A110102			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- This course aims at providing use of matrix algebra techniques for practical applications.
- This course aims at providing the student with the knowledge on Various numerical Methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Develop the use of matrix algebra techniques that is needed by engineers for practical applications.

CO2: Understand and solve the roots of equation using Bisection method, Iterative method, Regula-Falsi method, Newton Raphson method and solve the system of algebraic equations.

CO3: Apply concept of interpolation and derive interpolating polynomial using Newton's forward and backward formulae, Lagrange's formulae, Gauss forward and backward formulae.

CO4: Solving initial value problems to ordinary differential equations.

CO5: Determine the process of finding integral equations using Simson's 1/3, Simson's 3/8 Rule and Trapezoidal rule and fitting a best curve using least squares method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1	-

UNIT- I (10 Hrs)

Matrices: Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their Properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Diagonalization of a matrix.

Learning Outcomes: At the end of this unit, students should be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT - II (10 Hrs)

Solution of Algebraic & Transcendental Equations: Introduction-Bisection method-Iterative method-Regula-Falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan Method-Gauss Seidal method.

Learning outcomes: At the end of this unit, students should be able to

- Calculate the roots of equation using Bisection method and Iterative method. (L3)
- Calculate the roots of equation using Regula-Falsi method and Newton Raphson method. (L3)
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Seidal method. (L3)

UNIT - III (10 Hrs)

Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of interpolation. (L2)
- Derive interpolating polynomial using Newton's forward and backward formulae. (L3)
- Derive interpolating polynomial using Lagrange's formulae. (L3)
- Derive interpolating polynomial using Gauss forward and backward formulae. (L3)

UNIT - IV (12 Hrs)

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations- Euler's Method - Modified Euler's Method-Runge-Kutta Methods.

Learning Outcomes: At the end of this unit, students should be able to

- Solve initial value problems to ordinary differential equations using Taylor's method. (L3)
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods. (L3)

UNIT - V (12 Hrs)

Numerical Integration & Curve Fitting:

Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Fitting of straight line – second degree curve –Exponential curve –Power curve by the method of least squares.

Learning Outcomes: At the end of this unit, students should be able to

- Fit a best curve using method of least squares. (L3)
- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule. (L3)
- Solve integral equations using Trapezoidal rule. (L3)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna publishers.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India
3. "Introductory Methods of Numerical Analysis", S. S. Sastry, PHI publishers.

REFERENCE BOOKS:

1. "Higher Engineering Mathematics", B. V. Ramana, Mc Graw Hill publishers.
2. "Advanced Engineering Mathematics", Alan Jeffrey, Elsevier Publishers
3. "A Text Book of Engineering Mathematics Vol – I", T.K.V. Iyengar, B. Krishna Gandhi, S. Chand & Company.

Course Code	PROBABILITY AND STATISTICS (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110110			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize the students with the foundations of probability and statistical methods.
- To impart probability concepts and statistical methods in various applications Engineering.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Solve the central tendency, correlation and correlation coefficient and regression

CO2: Understand the terminologies of basic probability, two types of random variables and their probability functions.

CO3: Interpret the behavior of various discrete and continuous probability distributions.

CO4: Apply the concept of hypothesis testing for large samples.

CO5: Apply the statistics for testing the significance of the given small sample data by using t- test, F- test and Chi-square test.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	3	-	-	-	-	-	1	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-1 (12 Hrs)

Statistics Introduction, Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, regression lines, regression coefficients and their properties

Learning Outcomes: At the end of this unit, students should be able to

- summarize the basic concepts of data science and its importance in engineering (L2)
- analyze the data quantitatively or categorically, measure of averages, variability (L4)
- adopt correlation methods and regression analysis (L5)

UNIT-II (11 Hrs)

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Bayes theorem, random variables (discrete and continuous), probability density functions, properties.

Learning Outcomes: At the end of this unit, students should be able to

- Define the terms trial, events, sample space, probability, and laws of probability (L1)
- Make use of probabilities of events in finite sample spaces from experiments (L3)
- Apply Bayes theorem to real time problems (L3)
- Explain the notion of random variable, distribution functions and expected value (L2)

UNIT-III (12 Hrs)

Probability distributions: Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (L3)
- Interpret the properties of normal distribution and its applications (L2)

UNIT-IV (11 Hrs)

Estimation and Testing of hypothesis, large sample tests: Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of estimation, interval estimation and confidence intervals (L2)
- Apply the concept of hypothesis testing for large samples (L4)

UNIT-V (11 Hrs)

Small sample tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the concept of testing hypothesis for small samples to draw the inferences (L3)
- Estimate the goodness of fit (L5)

TEXTBOOKS:

1. "Miller and Freund's Probability and Statistics for Engineers", Richard A. Johnson, Pearson, 7/e, 2008.

2. "Fundamentals of Mathematical Statistics", S.C. Gupta and V.K. Kapoor, S. Chand & Sons Publications, 11/e, 2012.

REFERENCE BOOKS:

1. "A First Course in Probability", S. Ross, Pearson Education India, 2002.
2. "An Introduction to Probability Theory and its Applications", W. Feller, Wiley Publications, 1/e, 1968.
3. "Probability, Random Variables & Random Signal Principles", Peyton Z. Peebles, McGraw Hill Education, 4/e, 2001.

Course Code	ENGINEERING DRAWING (Common to all branches)		L	T	P	C
21A030301			**1**	**0**	**4**	**3**
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.
- Instruct graphical representation of machine components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Construction of various conic curves, Cycloid curves

CO2: Construction of projections of Points, Lines applied in engineering

CO3: Construction of projections of Planes.

CO4: Construction of projection of solids development of surfaces regular Solids.

CO5: Representation of Ortho and Isometric views of solids.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO4	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO5	3	2	2	-	3	-	-	-	-	2	-	2	2	2

UNIT-I (12 Hrs)

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance - Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, Epi-cycloid and Hypocycloid - general method only.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of engineering drawing (L2)
- Know the conventions used in the engineering drawing (L1)
- Identify the curves obtained in different conic sections (L2)
- Draw different cycloidal curves. (L3)

UNIT– II (12 Hrs)

Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, true angle made by line.

Learning Outcomes: At the end of this unit, students should be able to

- Know how to draw the projections of points, lines (L1)
- Find the true length of the lines. (L2)

UNIT-III (18 Hrs)

Projection of planes: Projections of regular plane inclined to both the planes and also draw the projections of different planes in Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of planes. (L2)
- Draw the projection of plane inclined to one plane and both the planes. (L3)
- Understand the different commands used in Computerized drawing to draw different planes. (L2)

UNIT- IV (15 Hrs)

Projections of solids: Projections of regular solids inclined to one or both planes by rotational method.

Development of Solids: Development of lateral Surfaces of Right Regular Solids (without section)-Prism, Cylinder, Pyramid, Cone.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of solids. (L2)
- Draw the projection of solid inclined to one plane. (L3)
- Draw the projection of solids inclined to both the planes. (L3)

UNIT–V (18 Hrs)

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Conversion of Isometric Views to Orthographic Views. Drawing the Isometric views using Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the basics convectional representation of different projections (L1)
- Draw the Orthographic projection of simple solids. (L3)
- Draw the Isometric projection of simple solids. (L3)

TEXTBOOKS:

1. "Engineering Drawing", K. L. Narayana & P. Kannaiah, SciTech Publishers, Chennai, 3/e.
2. "Engineering Drawing + AutoCAD", K. Venugopal, V. Prabhu Raja, New Age Publishers.
3. "Engineering Drawing", N. D. Bhatt, Charotar Publishers, 53/e, 2016

REFERENCE BOOKS:

1. "Engineering Drawing", Dhanajay A Jolhe, Tata McGraw-Hill, Copy Right, 2009.
2. "Engineering Drawing", Basant Agarwal & C. M. Agarwal, Tata McGraw-Hill
3. "Engineering Drawing", Shah and Rana, Pearson Education, 2/e, 2009

Course Code	ADVANCED DATA STRUCTURES THROUGH C++ (Common to CSE CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050304			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	II			

COURSE OBJECTIVES:

- To be familiar with basic techniques of object-oriented principles and exception handling using C++
- To be familiar with the concepts like Inheritance, Polymorphism
- Solve problems using data structures such as linear lists, stacks, queues
- Be familiar with advanced data structures such as balanced search trees.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Distinguish between procedures and object-oriented programming.
CO2: Apply advanced data structure strategies for exploring complex data structures.
CO3: Compare and contrast various data structures and design techniques in the area of Performance.
CO4: Implement data structure algorithms through C++.
CO5: Incorporate data structures into the applications such as binary search trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

UNIT-1 (13 Hrs)

Arrays: Abstract Data Types and the C++ Class, An Introduction to C++ Class- Data Abstraction and Encapsulation in C++- Declaring Class Objects and Invoking Member Functions- Special Class Operations- Miscellaneous Topics- ADTs and C++Classes, The Array as an Abstract Data Type, The Polynomial Abstract Data type- Polynomial Representation- Polynomial Addition. Spares Matrices.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about OOPS concepts (L3).
- Learn and solve about different types of Class Types and Polynomial representation (L3)

UNIT- II (10 Hrs)

Stacks and Queues: Templates in C++, Template Functions- Using Templates to Represent Container Classes, The Stack Abstract Data Type, The Queue Abstract Data Type, Subtyping and Inheritance in C++, Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as Templates in C++ (L3)
- Analyze the behaviour of different types of Classes, ADT and Expressions (L3)

UNIT – III (12 Hrs)

Linked Lists – I: Single Linked List and Chains, Representing Chains in C++, defining a Node in C++- Designing a Chain Class in C++- Pointer manipulation in C++- Chain Manipulation Operations, The Template Class Chain, Implementing Chains with Templates- Chain Iterators- Chain Operations- Reusing a Class, Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials

Learning Outcomes: At the end of this unit, students should be able to

- Learn and implement different types of Linked Lists (L3)
- Acquire the Knowledge of functions of Templates in C++ (L1)
- Implement Chain Iterators and Polynomials (L3)

UNIT – IV (13 Hrs)

Linked Lists – II: Polynomial Representation- Adding Polynomials- Circular List Representation of Polynomials, Equivalence Classes, Sparse Matrices, Sparse Matrix Representation- Sparse Matrix Input- Deleting a Sparse Matrix, Doubly Linked Lists, Generalized Lists, Representation of Generalized Lists- Recursive Algorithms for Lists Reference Counts, Shared and Recursive Lists

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables using Polynomial Representation (L5)
- Apply Matrix techniques in evaluating different types (L4)
- Evaluating Generalized Lists and Recursive algorithms (L5)

UNIT-5 (12 Hrs)

Trees: Introduction, Terminology, Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Tress, Binary Tree Representations, Binary Tree Traversal and Tree Iterators, Introduction, Inorder Traversal Preorder Traversal, Postorder Traversal, Thread Binary Trees, Threads, Inorder Traversal of a Threaded Binary Tree, Inserting a Node into a Threaded Binary Tree, Heaps, Priority Queues, Definition of a Max Heap, Insertion into a Max Heap, Deletion from a Max Heap, Binary Search Trees, Definition, Searching a Binary Search Tree, Insertion into a Binary Search Tree, Deletion from a Binary Search Tree, Height of Binary Search Tree.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Tree functions and its relations (L2)
- Conclude the use of different types of Trees representation (L4)

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2nd edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2nd edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3rd Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W.Savitch, Pearson education, Fourth edition

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING		L	T	P	C
21A020303	(Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To teach DC and AC electrical circuit analysis
- To explain working principles of transformers and electrical machines
- To impart knowledge on Power system generation, transmission and distribution
- Familiar with the theory, construction, and operation of electronic devices
- Learn about biasing of BJTs and FETs.
- Design and construct amplifiers, understand the concept & principles of logic devices.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Apply concepts of KVL/KCL in solving DC circuits
CO2: Illustrate working principles of DC Motor, Transformer and Induction motors
CO3: Understand the basics of Power generation, Transmission and Distribution
CO4: Explain the theory, construction, operation and working of electronic devices.
CO5: Analyze and design small signal amplifier circuits, logic gate, combinational and sequential circuits

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

Part A: Basic Electrical Engineering

UNIT-I (10 Hrs)

DC & AC Circuits: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms -peak and rms values - phasor representation - real power - reactive power - apparent power – power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

Learning Outcomes: At the end of this unit, students should be able to

- Recall Kirchoff laws (L1)

- Analyze simple electric circuits with DC excitation (L4)
- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations (L4)

UNIT-II (10 Hrs)

DC & AC Machines: Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator –principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single-Phase Transformer - OC and SC tests on transformer -Principle and operation of 3-phase AC machines [Elementary treatment only]

Learning Outcomes: At the end of this unit, students should be able to

- Explain principle and operation of DC Generator & Motor. (L2)
- Perform speed control of DC Motor (L3)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor - DC motor (L2)

UNIT-III (10 Hrs)

Basics of Power Systems: Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary& Secondary distribution systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand working operation of various generating stations (L1)
- Explain the types of Transmission and Distribution systems (L2)

TEXTBOOKS:

1. “Basic Electrical Engineering”, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2010.
2. “Principles of Power System”, V.K. Mehta & Rohit Mehta, S. Chand, 2018.

REFERENCE BOOKS:

1. “Fundamentals of Electrical Engineering”, L. S. Bobrow, Oxford University Press, 2011.
2. “Electrical and Electronics Technology”, E. Hughes, Pearson, 2010.
3. “Generation Distribution and Utilization of Electrical Energy”, C.L. Wadhwa, New Age International Publications, 3rd Edition.

Part 'B'- Electronics Engineering

UNIT-I (10 Hrs)

Diodes and Applications: Semiconductor Diode, Diode as a Switch& Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications of Zener Diode, LED, Photo Diode.

Transistor Characteristics: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Biasing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

Learning outcomes: At the end of this unit, students should be able to

- Remember and understand the basic characteristics of semiconductor diode. (L1)
- Understand principle of operation of Zener diode and other special semiconductor diodes (L1)
- Analyze BJT based biasing circuits. (L3)
- Design an amplifier using BJT based on the given specifications. (L4)

UNIT-II (10 Hrs)

Operational Amplifiers and Applications: Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

Learning outcomes: At the end of this unit, students should be able to

- Describe operation of Op-Amp based linear application circuits, converters, amplifiers and non-linear circuits. (L2)
- Analyze Op-Amp based comparator, differentiator and integrator circuits. (L3)

UNIT-III (10 Hrs)

Digital Electronics: Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder. Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters.

Learning outcomes: At the end of this unit, students should be able to

- Explain the functionality of logic gates. (L2)
- Apply basic laws and De Morgan's theorems to simplify Boolean expressions. (L3)
- Analyze standard combinational and sequential circuits. (L4)

TEXTBOOKS:

1. "Electronic Devices & Circuit Theory", R. L. Boylestad & Louis Nashlesky, Pearson Education, 2007.
2. "Op-Amps & Linear ICs", Ramakanth A. Gayakwad, Pearson, 4th Edition, 2017.
3. "Modern Digital Electronics", R. P. Jain, Tata Mcgraw Hill, 3rd Edition, 2003.
4. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2nd Edition, 2012.

REFERENCE BOOKS:

1. "Basic Electronics - Devices, Circuits and IT Fundamentals", Santiram Kal, Prentice Hall of India, 2002.
2. "A Text Book of Electronic Devices and Circuits", R. S. Sedha, S.Chand & Co, 2010.
3. "Introductory Electronic Devices & Circuits - Conventional Flow Version", R. T. Paynter, Pearson Education, 2009.

Course Code	COMMUNICATIVE ENGLISH LAB		L	T	P	C
21A110201	(Common to all branches)		0	0	2	1
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with special emphasis on Listening and Speaking skills.
- To equip students with professional skills & soft skills, Develop communication skills in formal and informal situations
- To help students present themselves confidently during Group Discussions and Oral Presentations

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Use creativity in listening to formal and informal conversations.
CO2: Analyze the concepts of active listening and barriers to listening.
CO3: Communicate effectively in everyday life using right oral expressions.
CO4: Acquire the confidence to present themselves effectively during academic and professional presentations.
CO5: Acquire basic knowledge of non-verbal communication and its importance.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	3	-	-	-	-	-

UNIT-I (6 Hrs)

Essentials of Listening: Purpose of Listening, Listening to Conversation (Formal and Informal), Active Listening- an Effective Listening Skill, Barriers to Listening, Listening to Announcements- (railway/ bus stations/ airport /sports announcement/commentaries etc.)

Learning Outcomes: At the end of this unit, students should be able to

- Know the difference between hearing and listening. (L2)
- Understand the purpose of active listening. (L2)
- Follow the announcements through focused listening. (L2)

UNIT-II (6 Hrs)

Listening Comprehension: Academic Listening (Listening to Lectures), Listening to Short Talks and Listening to Presentations, Note Taking Tips

Learning Outcomes: At the end of this unit, students should be able to

- Comprehend different academic lectures. (L3)
- Take notes while listening to short talks and lectures. (L3)
- Improve comprehension skills through listening to short talks and presentations. (L3)

UNIT-III (6 Hrs)

Communicating in everyday life: Asking for and giving information, Offering and responding to offers, Requesting and responding to requests, Congratulating people on their success, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving,

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate expressions to communicate in everyday life. (L3)
- Communicate effectively in different contexts of conversations. (L3)
- Participate in role plays and situational dialogues with an exposure to social and professional contexts. (L3)

UNIT- IV (6 Hrs)

Presentation Skills: Giving Short Talks, Preparing power point presentation, Greeting and Introducing in presentations, Presenting a paper, Participating in group discussions (dos & don'ts)

Learning Outcomes: At the end of this unit, students should be able to

- Prepare a power point presentation effectively. (L3)
- Present a paper in a seminar. (L3)
- Participate in Group Discussions efficiently. (L3)

UNIT-V (6 Hrs)

Non-verbal Communication: Personal Appearance, Gestures, Postures, Facial Expression, Eye Contact, Body Language (Kinesics), Silence, Tips for Improving Non-Verbal Communication

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of body language in communication (L2)
- Improve non-verbal communication skills (L3)
- Understand how body language and non-verbal communication affects the personality of an individual in a social and professional set-up. (L2)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://learnenglish.britishcouncil.org/skills/listening
2. https://agendaweb.org/listening/comprehension-exercises.html
3. https://www.123listening.com/
4. https://www.linguahouse.com/learning-english/skill-4-learners/listening
5. https://www.talkenglish.com/listening/listen.aspx
6. https://ed.ted.co

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A020304			0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To Verify Kirchoff's laws and Superposition theorem
- To learn performance characteristics of DC Machines and 1- Phase Transformer
- To Study the I – V Characteristics of Solar PV Cell
- To analyze the characteristics of Diodes, BJT, MOSFET, UJT
- To design the amplifier circuits from the given specifications.
- Exposed to linear and digital integrated circuits

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Understand Kirchoff's Laws & Superposition theorem.

CO2: Analyze the various characteristics on 1-phase transformer and DC Machines by conducting various tests.

CO3: Analyze I – V Characteristics of PV Cell

CO4: Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.

CO5: Construct and analyze the various diode rectifiers, clippers and clampers and other circuits.

CO-PO MAPPING;

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

PART A: ELECTRICAL ENGINEERING

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Load test on 1-Phase Transformer.
7. I – V Characteristics of Solar PV cell

8. Brake test on DC Shunt Motor.

PART B: ELECTRONICS ENGINEERING

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Full Wave Rectifier with & without filter.
4. Wave Shaping Circuits. (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration.
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting amplifiers using Op-AMPs.
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
9. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs all the required active devices

Note: Minimum of Six Experiments to be performed in each section.

<table>
<tr><th>Course Code</th><th colspan="2" rowspan="2">ADVANCED DATA STRUCTURES THROUGH C++ LAB
(Common to CSE, CSE-AI, AIML, CSE-IOT)</th><th>L</th><th>T</th><th>P</th><th>C</th></tr>
<tr><td>21A050305</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Pre-requisite</td><td>C Programming & Data Structures</td><td>Semester</td><td colspan="4">II</td></tr>
</table>

COURSE OBJECTIVES:

- To familiarize Advanced data structures using C++.
- To train the students on the sorting techniques
- To introduce Trees.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C++ using Trees.
CO3: Modularize the problem and also solution.
CO4: Design applications in C++ using Searching Techniques
CO5: Explore various operations on Linked Lists

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

1. Write a C++ program to sort the given data elements using bubble sort technique.
2. Write a C++ program to sort the given data elements using selection sort technique.
3. Write a C++ program to search a given element from the list of elements using linear search technique.
4. Write a C++ program to search a given element from the list of elements using binary search technique.
5. Write a C++ program to implement Stack ADT using an array.
6. Write a C++ program to implement Linear Queue ADT using an array.
7. Write a C++ program to implement Circular Queue ADT using an array.
8. Write a C++ program to implement Deque ADT using an array.
9. Write a C++ program to create a Single linked list ADT and display the elements.
10. Write a C++ program to create a Double linked list ADT and display the elements.
11. Write a C++ program to create a Circular single linked list and display the elements.
12. Write a C++ program to create a Circular double linked list and display the elements.
13. Write a C++ program to implement Stack ADT using linked list.

14. Write a C++ program to implement Linear Queue ADT using linked list.
15. Write a C++ program to create a binary search tree with the given data elements 23, 54, 12, 43, 56, 10, 52, 35 and apply In-order, Preorder and Post-order tree traversal techniques.

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2nd edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2nd edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3rd Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W. Savitch, Pearson education, Fourth edition

Course Code	BIOLOGY FOR ENGINEERS		L	T	P	C
21A000005	(Common for CSE-AI, AIML)		2	0	0	0
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To provide basic understanding about life and life Process. Animal and plant systems.
- To understand what biomolecules, are, their structures are functions.
- Application of certain biomolecules in Industry.
- Brief introduction about human physiology and bioengineering.
- To understand hereditary units, i.e., DNA (genes) and RNA and their synthesis in living organism.
- How biology Principles can be applied in our daily life using different technologies.
- Brief introduction to the production of transgenic microbes, Plants and animals.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.

CO2: Explain about biomolecules, their structure and function and their role in the living organisms.

CO3: How biomolecules are useful in Industry.

CO4: Briefly about human physiology.

CO5: Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	1	-	-

UNIT – I (10 Hrs)

Introduction to Basic Biology: Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the basis of life. (L1)

- Understand the difference between lower organisms (prokaryotes) from higher organisms(eukaryotes). (L2)
- Understand how organisms are classified. (L3)

<u>UNIT – II</u> (10 Hrs)

Introduction to Biomolecules: Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand what are biomolecules? their role in living cells, their structure, function and how they are produced. (L1)
- Interpret the relationship between the structure and function of nucleic acids. (L2)
- Summarize the applications of enzymes in industry. (L3)
- Understand what is fermentation and its applications of fermentation in industry. (L4)

<u>UNIT – III</u> (10 Hrs)

Human Physiology: Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

Learning Outcomes: At the end of this unit, students should be able to

- Understand what nutrients are (L1)
- Understand the mechanism and process of important human functions (L2 & L3)
- Select suitable fuels for IC engines (L3)
- Explain calorific values, octane number, refining of petroleum (L2)

<u>UNIT – IV</u> (10 Hrs)

Introduction to Molecular Biology and recombinant DNA Technology: Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. rDNA technology. Introduction to gene cloning.

Learning Outcomes At the end of this unit, students should be able to

- Understand and explain about gene structure and replication in prokaryotes and Eukaryotes (L1)
- Understand how genetic material is replicated and how RNA and proteins are synthesized. (L2)
- Understand about recombinant DNA technology and its application in different fields. (L3)
- Explain what is cloning. (L4)

UNIT – V (10 Hrs)

Application of Biology: Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, biochips, Bio fuels, and Bio Engineering. Basics of Production of Transgenic plants and animals.

Learning Outcomes: At the end of this unit, students should be able to

- Understand, how biology is applied for production of useful products for mankind. (L1)
- What are biosensors, biochips etc. (L2)
- Understand transgenic plants and animals and their production (L3)

TEXTBOOKS:

1. "Cell and Molecular Biology", P. K. Gupta, Rastogi Publications, 5th Edition.
2. "Biotechnology", U. Satyanarayana., Books & Allied Ltd, 2017.

REFERENCE BOOKS:

1. "Biology: A Global Approach", N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, Pearson Education Ltd, 2018.
2. "Biology for Engineers", T Johnson, CRC press, 2011.
3. "Molecular Biology and Biotechnology", J.M. Walker and E.B. Gingold, Panima Publications, 2nd edition.
4. "Instant Notes in Biochemistry", David Hames, 2016.
5. "Instant Notes – Molecular Biology", Phil Tunner, A. McTennan, A. Bates & White, 2014.

Course Code	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110111			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To explain about the Boolean algebra, Graph theory and Recurrence relations.
- To demonstrate the application of basic methods of discrete mathematics in Computer Science problem solving.
- To elucidate solving mathematical problems from algorithmic perspective.
- To introduce the mathematical concepts which will be useful to study advanced courses Design and Analysis of Algorithms, Theory of Computation, Cryptography and Software Engineering etc.
- To reveal how solutions of graph theory can be applied to computer science problems

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Evaluate elementary mathematical arguments and identify fallacious reasoning

CO2: Understand the properties of Compatibility, Equivalence and Partial Ordering relations, Lattices and Hassee Diagrams and the general properties of Algebraic Systems

CO3: Design solutions for problems using Permutations and Combinations

CO4: Solve the homogeneous and non-homogeneous recurrence relations

CO5: Apply the concepts of functions to identify different types of Graphs and trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Statements and Notation, **Connectives-** Negation, Conjunction, Disjunction, Conditional and Bi-conditional, Statement formulas and Truth Tables. Well-formed formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications.

Normal Forms: Disjunctive Normal Forms, Conjunctive Normal Forms, Principal Disjunctive Normal Forms (PDNF), Principal Conjunctive Normal Forms (PCNF), Ordering and Uniqueness of Normal Forms.

The Theory of Inference for the Statement Calculus: Rules of Inference, Consistency of Premises and Indirect Method of Proof. The predicate Calculus, Inference theory of the Predicate Calculus

Learning Outcomes: At the end of this unit, students should be able to

- Describe logical sentences in terms of predicates, quantifiers, and logical connectives (L1)
- Evaluate basic logic statements using truth tables and the properties of logic (L5)
- Apply rules of inference to test the consistency of premises and validity of arguments (L3)
- Verify the equivalence of two formulas and their duals (L4)
- Find the Principal Conjunctive and Principal Disjunctive Normal Forms of a statement formula. (L1)

UNIT-II (12 Hrs)

Set Theory: Basic concepts of Set Theory, Representation of Discrete structures, Relations and Ordering, Functions, Recursion.

Lattices and Boolean algebra: Lattices as Partially Ordered Sets, Boolean algebra, Boolean Functions, Representation and Minimization of Boolean Functions.

Algebraic Structures: Algebraic Systems: Examples and General Properties, Semi Groups and Monoids, Groups.

Learning Outcomes: At the end of this unit, students should be able to

- Describe equivalence, partial order and compatible relations (L1)
- Compute Maximal Compatibility Blocks (L3)
- Identify the properties of Lattices (L2)
- Evaluate Boolean functions and simplify expression using the properties of Boolean Algebra (L5)
- Infer Homomorphism and Isomorphism (L4)
- Describe the properties of Semi groups, Monoids and Groups (L1)

UNIT-III (10 Hrs)

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Permutations and Combinations with constrained Representations, Binomial Coefficients, The Binomial and Multinomial Theorems, The Principle of Inclusion and Exclusion

Learning Outcomes: At the end of this unit, students should be able to

- Explain fundamental principle of counting (L2)
- Examine the relation between permutation and combination (L4)

- Solve counting problems by applying elementary counting techniques using the product and sum rules (L3)
- Apply permutations, combinations, the pigeon-hole principle, and binomial expansion to solve counting problems (L3)

UNIT-IV (10 Hrs)

Recurrence Relations: Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, The method of Characteristic Roots, Solution of Inhomogeneous Recurrence Relations.

Learning Outcomes: At the end of this unit, students should be able to

- Find the generating functions for a sequence (L1)
- Design recurrence relations using the divide-and-conquer algorithm (L6)
- Solve linear recurrence relations using method of Characteristic Roots (L3)
- Outline the general solution of homogeneous or Inhomogeneous Recurrence Relations using substitution and method of generating functions (L2)
- Solve problems using recurrence relations and recursion to analyze complexity of Algorithms (L3)

UNIT-V (10 Hrs)

Graphs: Basic Concepts, Isomorphism and Sub graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatics Number, The Four-Color Problem

Learning Outcomes: At the end of this unit, students should be able to

- Investigate if a given graph is simple or a multigraph, directed or undirected, cyclic or acyclic (L4)
- Describe complete graph and complete bipartite graphs (L1)
- Identify Euler Graphs, Hamilton Graph and Chromatic Number of a graph (L2)
- Apply the concepts of functions to identify the Isomorphic Graphs (L3)
- Apply depth-first and breadth-first search (L3)
- Apply Prim's and Kruskal's algorithms to find a minimum spanning tree (L3)

TEXTBOOKS:

1. "Discrete Mathematics for Computer Scientists & Mathematicians", Joe L. Mott. Abraham Kandel and Theodore P. Baker, Pearson, 2008, 2nd Edition,
2. "Discrete Mathematical Structures with Applications to Computer Science", J P Trembly and R Manohar, McGraw Hill, 2017, 1st Edition.

REFERENCE BOOKS:

1. "Discrete and Combinatorial Mathematics, an Applied Introduction", Ralph P. Grimaldi and B.V. Ramana, Pearson, 2016, 5th Edition.
2. "Graph Theory with Applications to Engineering", Narsingh Deo, Prentice Hall, 1979.
3. "Discrete Mathematics theory and Applications", D.S. Malik and M.K. Sen, Cengage Learning, 2012, 1st Edition.
4. "Elements of Discrete Mathematics, A computer Oriented approach", C L Liu and D P Mohapatra, McGraw Hill, 2018, 4th edition.

Course Code	DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050401			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To understand the basic theoretical concepts of digital systems like the binary system and Boolean algebra.
- To express real life problem in logic design terminology.
- To use Boolean algebraic formulations to design digital systems. To design using combinational/sequential circuits
- To understand the Instruction execution stages.
- To explain the functions of the various computer hardware components.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Identify the basic functional units and different ways of interconnecting to form a computer system.

CO2: Design; understand the number systems, combinational sequential circuits.

CO3: Inspect the Computer Arithmetic operations performed on fixed point and floating-point numbers.

CO4: Apply effective memory management strategies

CO5: Describe various techniques for I/O data transfer methods and interrupt handling mechanisms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	-	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	1		-	-	-	-	-	-	-	-	-

UNIT- I (12 Hrs)

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations.

Data Representation: Binary Numbers, Fixed Point Representation. Floating – Point Representation. Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Identify the basic functional units and different ways of interconnecting to form a computer system. (L2)
- Summarize the binary number system (L2)
- Illustrate various binary codes (L3)

UNIT- II (12 Hrs)

Digital Logic Circuits - I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. Flip-flops, Combinational Circuits.

Digital Logic Circuits - II: Registers, Shift Registers, Binary counters, Decoders, Multiplexers, Programmable Logic Devices.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Develop a logic diagram using gates from a Boolean function (L3)
- Apply the map method for simplifying Boolean Expressions. (L2)
- Analyze and design combinational circuits. (L3)
- Explain the functionalities of latch and different flip-flops (L2)

UNIT- III (12 Hrs)

Computer Arithmetic: Algorithms for fixed point and floating-point addition, subtraction, multiplication and division operations, Hardware Implementation of arithmetic and logic operations, High performance arithmetic.

Instruction Set & Addressing: Memory Locations and Addresses, Machine addresses and sequencing, Various Addressing Modes, Instruction Formats, Basic Machine Instructions, IA-32 Pentium example.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Illustrate various addressing modes for accessing register and memory operands. (L3)
- Describe the instruction sequencing and various types of instructions. (L2)
- Describe the operations performed on floating point numbers. (L2)

UNIT- IV (11 Hrs)

Processor Organization: Introduction to CPU, Register Transfers, Execution of Instructions, Multiple Bus Organization, Hardwired Control, Microprogrammed Control.

Memory Organization: Concept of Memory, RAM, ROM memories, memory hierarchy, cache memories, virtual memory, secondary storage, memory management requirements.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Distinguish between hardwired and micro programmed control units. (L3)
- Recognize the various types of memories. (L2)
- Analyze the performance of cache memory. (L3)

- Apply effective memory management strategies (L2)

UNIT- V (11 Hrs)

Input / Output Organization: Introduction to I/O, Interrupts- Hardware, Enabling and disabling Interrupts, Device Control, Direct memory access, buses, interface circuits, standard I/O Interfaces.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Examine the basics of I/O data transfer synchronization. (L3)
- Analyze the interrupt handling mechanisms of various processors. (L3)
- Describe various techniques for I/O data transfer methods. (L2)

TEXTBOOKS:

1. "Computer Organization", Carl Hamacher, ZvonkoVranesic, SafwatZaky, McGraw Hill, 5th edition.
2. "Computer Architecture and Organization- An Integrated Approach", Miles Murdocca, Vincent Heuring, Wiley India, Second Edition.
3. "Computer Systems Architecture", M. Morris Mano, Pearson, 3rd Edition.

REFERENCE BOOKS:

1. "Computer Organization and Architecture", William Stallings, Pearson, Sixth Edition,
2. "Computer - organization and Design", David A. Paterson and John L. Hennessy, Elsevier.
3. "Fundamentals or Computer Organization and Design", Sivarama Dandamudi, Springer Int. Edition.
4. "Digital Design", M. Morris Mano, Pearson Education/PHI, Third Edition
5. "Fundamentals of Logic Design", Roth, Thomson, 5th Edition.

Course Code	DATABASE MANAGEMENT SYSTEMS		L	T	P	C
21A050402	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Train in the fundamental concepts of database management systems, database modelling and design, SQL, PL/SQL and system implementation techniques.
- Enable students to model ER diagram for any customized application
- Inducting appropriate strategies for optimization of queries.
- Provide knowledge on concurrency techniques
- Demonstrate the organization of Databases

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		-	-	-	-	-	-	-	2	1	-
CO2	3	2	3	3	-	-	-	-	-	-	3	3	1	-
CO3	-	2	3	3	-	-	-	-	-	-	2	-	1	-
CO4	-	2	-	3	2	-	-	-	-	-	-	-	-	2
CO5	-	-	-	3	3	-	-	-	-	-	-	3	-	2

UNIT-I (12 Hrs)

Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators.

Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between Database and File System (L3)
- Categorize different kinds of data models (L4)
- Define functional components of DBMS (L1)

UNIT-II **(12 Hrs)**

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL**:** Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization.

Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the elements of the relational model such as domain, attribute, tuple, relation, and entity (L4)
- Distinguish between various kinds of constraints like domain, key, and integrity (L4)
- Define relational schema (L1)
- Develop queries using Relational Algebra and SQL (L6)
- Perform DML operations on databases (L3)

UNIT-III **(12 Hrs)**

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues.

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms

Learning Outcomes: At the end of this unit, students should be able to

- Develop E-R model for the given problem (L6)
- Derive tables from E-R diagrams (L6)
- Differentiate between various normal forms based on functional dependency (L4)
- Apply normalization techniques to eliminate redundancy (L3)

UNIT-IV **(11 Hrs)**

Query Processing: Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions.

Query optimization: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.

Learning Outcomes: At the end of this unit, students should be able to

- Identify variety of methods for effective processing of given queries. (L2)

- Obtain knowledge related to optimization techniques. (L6)

UNIT-V (12 Hrs)

Transaction Management: Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.

Concurrency Control: Lock based Protocols, Deadlock Handling, Multiple granularities, Timestamp based Protocols, Validation based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Non-volatile Storage, Early Lock Release and Logical Undo Operations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various properties of transaction. (L2)
- Design atomic transactions for an application. (L6)
- Gain the knowledge about log mechanism and check pointing techniques for system recovery. (L6)

TEXTBOOKS:

1. "Database System Concepts" A. Silberschatz, H. F. Korth, S. Sudarshan, TMH, 2019, 6/e.

REFERENCE BOOKS:

1. "Database Management System", Shamkant B. Navathe, Ramez Elmasri, PEA, 6/e.
2. "Database Principles Fundamentals of Design Implementation and Management", Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
3. "Database Management Systems", Raghurama Krishnan, Johannes Gehrke, TMH, 3/e.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050403			3	0	0	3
Pre-requisite	C-Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

COURSE OUTCOMES:

Students will be able to:

CO1: To solve real world problems using OOP techniques.
CO2: To apply code reusability through inheritance, packages, and interfaces
CO3: To develop applications by using parallel streams for better performance.
CO4: To solve problems using java collection framework and I/O classes.
CO5: To develop applets for web applications, to build GUIs and handle events generated by user interactions, to use the JDBC API to access database

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	3	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	3	-	-	-	-	-	3	3	-	2

UNIT–I (12 Hrs)

Introduction: Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the syntax, semantics, and features of Java Programming Language. (L2)
- Learn object-oriented features and understanding type conversion and casting. (L2)
- Understand different types of string handling functions and its usage. (L2)

UNIT–II **(10 Hrs)**

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, finding packages and CLASSPATH, Access Protection, Importing packages.

Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

Learning Outcomes: At the end of this unit, students should be able to

- Implement types of Inheritance and developing new classes based on existing classes (L3)
- Distinguish between system packages and user defined packages. (L4)
- Demonstrate features of interfaces to implement multiple inheritances. (L3)

UNIT – III **(12 Hrs)**

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes.

Stream based I/O (java.io) – The Stream Classes-Byte streams and Character streams, reading console Input and Writing Console Output, File class, Reading and
writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

Learning Outcomes: At the end of this unit, students should be able to

- Learn what exceptions are and how they are handled. (L2)
- Learn when to use exception handling and how to create user defined exceptions (L6)
- Learn the difference between various files and streams. (L4)

UNIT – IV **(12 hrs)**

Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hash table, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

Learning Outcomes: At the end of this unit, students should be able to

- Understand concurrency, parallelism, and multithreading (L2)
- Learn the importance of collections and use prebuilt generic data structures from framework. (L3)

UNIT-V (12 hrs)

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirm dialog, show input dialog, show option dialog, jdialog, create a modeles sdialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Learning Outcomes: At the end of this unit, students should be able to

- Learn how to use the Nimbuslook-and-feel (L3)
- Understand the GUI programming. (L2)
- Understand basic steps in developing JDBC applications (L2)

TEXTBOOKS:

1. "Java The complete reference", Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd, 9th edition.
2. "Java How to Program", Paul Dietel, Harvey Dietel, Pearson Education,10th Edition.

REFERENCE BOOKS:

1. "Understanding Object-Oriented Programming with Java", T. Budd, Pearson Education, updated edition.
2. "Core Java Volume – 1 Fundamentals", Cay S. Horstmann, Pearson Education.
3. "Java Programming for core and advanced learners", Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press
4. "Introduction to Java programming", Y. Daniel Liang, Pearson Education.
5. Object Oriented Programming through Java", P. Radha Krishna, "University Press.
6. "Programming in Java", S. Malhotra, S. Choudhary, Oxford Univ. Press, 2nd edition.
7. "Java Programming and Object-oriented Application Development", R.A. Johnson, Cengage Learning.

Course Code	PYTHON PROGRAMMING & DATA SCIENCE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050306			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To learn the fundamentals of Python.
- To discuss the concepts of Functions and Exceptions.
- To familiarize with Python libraries for Data Analysis and Data Visualization.
- To introduce preliminary concepts in Pattern Recognition and Machine learning.
- To provide an overview of Deep Learning and Data Science models.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.

CO2: Demonstrate proficiency in handling Strings and File Systems.

CO3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.

CO4: Interpret the concepts of NumPy, MatPlotLib, & Pandas as used in Python.

CO5: Implement exemplary applications related to Machine Learning, Deep learning and Data Science Models in Python.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language,

Control Flow Statements: The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions used on Lists, List Methods, The del Statement.

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples
Learning outcomes: At the end of this unit, students should be able to

- List the basic constructs of Python. (L1)
- Apply the conditional execution of the program (L3)
- Use the data structure lists, Dictionaries and Tuples (L3)

UNIT-II (10 Hrs)
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings,
Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters.
Errors and Exceptions: What Are Exceptions? Exceptions in Python, Detecting and Handling Exceptions, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions
Learning Outcomes: At the end of this unit, students should be able to

- Design programs for manipulating strings (L6)
- Solve the problems by applying the modularity principle. (L3)
- Classify exceptions and explain the ways of handling them. (L4)

UNIT-III (10 hrs)
Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files,
Introduction to **NumPy, Pandas, Matplotlib**.
Exploratory Data Analysis (EDA): Data Science life cycle, Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA.
Data Visualization: Scatter plot, bar chart, histogram, boxplot, heat maps, etc
Learning Outcomes: At the end of this unit, students should be able to

- Creating file handling scripts. (L6)
- Demonstrate various mathematical operations on arrays using NumPy (L2)
- Analyze and manipulate Data using Pandas (L4)
- Creating static, animated, and interactive visualizations using Matplotlib. (L6)

UNIT-IV (15 hrs)
Introduction to Pattern Recognition and Machine Learning: Patterns, features, pattern representation, the curse of dimensionality, dimensionality reduction.

Classification—linear and non-linear. Bayesian, Nearest neighbor classifier, Logistic regression, Naïve-Bayes, decision trees and random forests; boosting and bagging.
Clustering---partitional and hierarchical; k-means clustering. Regression.
Cost functions, Cross-validation, Confusion matrix, evaluation metrics
Learning Outcomes: At the end of this unit, students should be able to

- Define Patterns and their representation (L1)
- Describe the Classification and Clustering (L2)
- Illustrate cost functions and class imbalance (L3)

UNIT-V (10 hrs)
Introduction to Deep Learning: Perceptron, Multilayer perceptron. Back propagation. Loss functions. Hyper parameter tuning, Overview of RNN, CNN and LSTM.
Overview of Data Science Models: Applications to text, images, recommender systems, image classification, Social network graphs
Learning Outcomes: At the end of this unit, students should be able to

- Describe RNN, CNN and LSTM (L2)
- Explain the applications of Data Science (L2)

TEXTBOOKS:

1. "Think Python", Allen B. Downey, SPD/O'Reilly, 2nd edition, 2016
2. "Doing Data Science, Straight Talk from the Frontline", Cathy O'Neil, Rachel Schutt, O'Reilly, 2013.
3. "Pattern Recognition and Machine Learning", Christopher Bishop, Springer, 2007.

REFERENCE BOOKS:

1. "Introduction to Python Programming", Gowri Shankar S, Veena A, CRC Press/Taylor & Francis, 1st Edition, 2018. ISBN-13: 978-0815394372,
2. "Python Data Science Handbook: Essential Tools for Working with Data", Jake Vander Plas, O'Reilly Media, 1st Edition, 2016. ISBN-13: 978-1491912058
3. "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Aurelien Geron, O'Reilly Media, 2nd Edition, 2019. ISBN – 13: 978-9352139057
4. "Core Python Applications Programming", Wesley J Chun, Pearson Education India, 3rd Edition, 2015. ISBN-13: 978-9332555365.
5. "Flask Web Development: Developing Web Applications with Python", Miguel Grinberg, O'Reilly Media, 2nd Edition, 2018. ISBN-13: 978-1491991732.

Course Code	DATABASE MANAGEMENT SYSTEMS LAB		L	T	P	C
21A050404	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To implement the basic knowledge of SQL queries and relational algebra.
- To construct database models for different database applications.
- To apply normalization techniques for refining of databases.
- To practice various triggers, procedures, and cursors using PL/SQL.
- To design and implementation of a database for an organization

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

I. CREATION OF DATA BASE TABLES

1. Create a table called Employee with fields (Empno, Ename, Job, Mgr, Sal)
   a. Add a column commission with domain to the Employee table.
   b. Insert any five records into the table.
   c. Update the column details of job
   d. Rename the column of Employ table using alter command.
   e. Delete the employee whose empno is 19

2. Create department table with fields (Deptno, Deptname, Location).
   a. Add column designation to the department table.
   b. Insert values into the table.
   c. List the records of emp table grouped by dept no.

d. Update the record where dept no is 9.
e. Delete any column data from the table.

II: EXECUTING QUERIES USING DDL AND DML COMMANDS

1. a. Create a user and grant all permissions to the user on employee table.
   b. Insert the any three records in the employee table and use rollback. Check the result.
   c. Add primary key constraint and not null constraint to the employee table.
   d. Insert null values to the employee table and verify the result.
   e. By using the group by clause, display the names who belongs to dept no 10 along with average salary.
   f. Display lowest paid employee details under each department.
   g. Display number of employees working in each department and their department number
2. a. Create a user and grant all permissions to the user on department table
   b. Insert values in the department table and use commit.
   c. Add constraints like unique and not null to the department table.
   d. Insert repeated values and null values into the table.
   e. Calculate the average salary for each different job.
   f. Show the average salary of each job excluding manager.
   g. Show the average salary for all departments employing more than three people.
   h. Display employees who earn more than the lowest salary in department30

III. CASE STUDIES:

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records
10. Supply chain management system

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

REFERENCE BOOKS:

1. “Database Systems”, Ramez Elmasri, Shamkant, B. Navathe, Pearson Education, 6th Edition, 2013.
2. “Database System Concepts” Peter Rob, Carles Coronel, Cengage Learning, 7th Edition, 2008.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050405			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To introduce the concepts of Java.
- To Practice object-oriented programs and build java applications.
- To implement java programs for establishing interfaces.
- To implement sample programs for developing reusable software components.
- To establish database connectivity in java and implement GUI applications.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Recognize the Java programming environment.
CO2: Develop efficient programs using multithreading.
CO3: Design reliable programs using Java exception handling features.
CO4: Extend the programming functionality supported by Java.
CO5: Select appropriate programming construct to solve a problem.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF APPLICATIONS

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records

10. Supply chain management system

For Every Application:

The following Tasks need to be done:

1. Write a java program to create classes and declare variables?
2. Write a java program to create a constructor?
3. Write a java program to perform exception handling to catch runtime exceptions?
4. Write a java program to implement inheritance for increasing reusability of code?
5. Write a java program to create interfaces for achieving data abstraction?
6. Write a java program to create files for input and output data storage?
7. Write a java program for implementing collection framework for effective management of data objects?
8. Write a java program for creating Graphical User Interface using swings?
9. Write a java program for implementing jdbc connectivity for application connecting with database?

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

Course Code	PYTHON PROGRAMMING & DATA SCIENCE LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050307			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- Practical understanding of building different types of models and their evaluation

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Illustrate the use of various data structures. (L3)
CO2: Analyze and manipulate Data using Pandas (L4)
CO3: Creating static, animated, and interactive visualizations using Matplotlib. (L6)
CO4: Understand the implementation procedures for the machine learning algorithms. (L2)
CO5: Apply appropriate data sets to the Machine Learning algorithms (L3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Week 1
Write a program to demonstrate a) Different numeric data types and b) To perform different Arithmetic Operations on numbers in Python.

Week 2
Write a program to create, append, and remove lists in Python.

Week 3
Write a program to demonstrate working with tuples in Python.

Week 4
Write a program to demonstrate working with dictionaries in Python.

Week 5
Write a program to demonstrate a) arrays b) array indexing such as slicing, integer array indexing and Boolean array indexing along with their basic operations in NumPy.

Week 6
Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.

Week 7
Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be the input that to be written to the second file.

Week 8
Write a program to demonstrate Regression analysis.

Week 9
Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Week 10
Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file.

Week 11
Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.

Week 12
Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various “k” values for the quality of clustering.

Week 13
Write a program to build Artificial Neural Network and test the same using appropriate data sets.

TEXTBOOKS:

1. “Deep Learning with Python”, Francois Chollet, Manning Publications Company, 1/e, 2017.
2. “How to Think Like a Computer Scientist: Learning with Python 3”, Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, 3rd edition. URL: http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. “Head First Python a Brain Friendly Guide”, Paul Barry, O’Reilly, 2nd Edition, 2016
4. “Pandas for Everyone Python Data Analysis”, Daniel Y. Chen, Pearson Education, 2019

Course Code	MATLAB PROGRAMMING		L	T	P	C
21A310701			1	0	2	2
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- Understand the concepts of Game design and development.
- Learn the processes, mechanics and issues in Game Design.
- Be exposed to the Core architectures of Game Programming.
- Know about Game programming platforms, frame works and engines.
- Learn to develop games.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Gain knowledge of basic procedural programming concepts and computational thinking
CO2: Become proficient in the use of modern computational tools
CO3: Develop basic problem-solving skills
CO4: Develop experience in designing a solution to engineering problems using software
CO5: Be able to document solutions to engineering problems and communicate the results

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS

Week 1 – Week 4: MODULE-I

Introduction to MATLAB - Characters, Relational Expressions, Vectors, Matrices. Introduction to programming, scripts, I/O, plots, Functions and commands

All the above must be practiced with exercises and Hands-on examples using the existing tool boxes

Week 5 – Week 8: MODULE - II

Loops and Branching statements, Vectorizing and Timing codes

All the above must be practiced with exercises and Hands-on examples using the existing tool boxes

Week 9 – Week 12: MODULE - III

User Interface design: MATLAB Program Organization, Debugging, Live-scripts, Data Transfer
All the above must be practiced with exercises and Hands-on examples using the existing tool boxes

TEXTBOOKS:

1. "MATLAB: A Practical Introduction to Programming and Problem solving", Storm Attaway, Elsevier, Fifth Edition, 2018.

Course Code	CONSTITUTION OF INDIA		L	T	P	C
21A000002	(Common to all branches)		2	0	0	0
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Understand historical background of the constitution making and its importance for building a democratic India.

CO2: Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India.

CO4: Analyze the decentralization of power between central, state and local self-government

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO2	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO3	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO4	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO5	-	-	-	-	-	3	-	2	1	-	-	1	-	-

UNIT – I (10 Hrs)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution-Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Indian constitution (L1)
- Apply the knowledge on directive principle of state policy (L3)
- Analyze the History and features of Indian constitution (L4)
- Learn about Preamble, Fundamental Rights and Duties (L1)

UNIT-II (10 Hrs)

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of Indian government (L1)
- Differentiate between the state and central government (L4)
- Explain the role of President and Prime Minister (L2)
- Know the Structure of supreme court and High court (L1)

UNIT-III (10 Hrs)

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of state government (L1)
- Analyze the role of Governor and Chief Minister (L4)
- Explain the role of State Secretariat (L2)
- Differentiate between structure and functions of state secretariat (L4)

UNIT-IV (10 Hrs)

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning Outcomes: At the end of this unit, students should be able to

- Understand the local Administration (L1)
- Compare and contrast district administration's role and importance (L4)
- Analyze the role of Mayor and elected representatives of Municipalities (L4)
- Learn about the role of Zilla Parishath block level organization (L1)

UNIT-V (10 Hrs)

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Learning Outcomes: At the end of this unit, students should be able to

- Know the role of Election Commission (L1)

- Contrast and compare the role of Chief Election commissioner and Commissionerate (L4)
- Analyze the role of state election commission (L4)
- Evaluate various commissions viz SC/ST/OBC and women (L6)

TEXTBOOKS:

1. "Introduction to the Constitution of India", Durga Das Basu, Prentice Hall of India Pvt. Ltd. New Delhi
2. "Indian Constitution", Subash Kashyap, National Book Trust

REFERENCE BOOKS:

1. "Dynamics of Indian Government & Politics", J.A. Siwach,
2. "Constitutional Law of India", H.M.Sreevai, 4th edition in 3 volumes (Universal Law Publication)
3. "Indian Government and Politics", J.C. Johari, Hans India

Course Code	ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS		L	T	P	C
21A310402			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	IV			

COURSE OBJECTIVES:

- Define Artificial Intelligence and establish the cultural background for study
- Understand various learning algorithms
- Explore the searching and optimization techniques for problem solving.
- Illustrate the importance of knowledge representation
- Understand Neural networks and its types.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Examine how an agent can learn from success and failure, reward and punishment.
CO2: Learn different searching techniques to solve a problem.
CO3: Explain how knowledge can be represented using propositional and First order logic.
CO4: Solve real world problems using Neural network concepts.
CO5: Implement applications using forward and backward neural networks.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3	-	-	-	2	-	2	2	1	-
CO2	2	2	2	2	2	-	-	-	2	-	2	2	1	-
CO3	3	3	3	3	2	-	-	-	2	-	2	3	1	-
CO4	3	3	2	2	3	-	-	-	2	-	3	1	-	2
CO5	3	3	2	3	2	-	-	-	1	-	1	2	-	2

UNIT – I (12 Hrs)

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

Learning Outcomes: At the end of this unit, students should be able to

- Get knowledge on foundations of AI. (L2)
- Understand Agents working environments (L2)
- Problem formulation methodologies. (L2)

UNIT – II (12 Hrs)

Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Greedy best first search, A* search.

Learning Outcomes: At the end of this unit, students should be able to

- Learn Uninformed searching methodologies (L2)
- Learn Informed searching methodologies (L2)

UNIT – III (11 Hrs)

Knowledge Representation & Reasons: Logical Agents, Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in propositional logic, Resolution, Forward & Backward. Chaining. First order logic. Inference in first order logic, propositional Vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of knowledge for agent (L2)
- Learn basic concepts of forward and backward chaining. (L3)
- Practice the resolution process. (L3)

UNIT – IV (10 Hrs)

Introduction to NN: Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units.

Learning Outcomes: At the end of this unit, students should be able to

- Understand major features of Neural Networks. (L2)
- Learn and practice various concepts in ANN (L2)
- Learn how to perform pattern recognition using functional units. (L3)

UNIT – V (11 Hrs)

Feed Forward Neural Networks: Introduction, Analysis of pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of pattern storage Networks. Analysis of Pattern Mapping Networks.

Feedback Neural Networks: Introduction, Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of forward and backward neural networks. (L2)

TEXTBOOKS:

1. "Artificial Intelligence – A Modern Approach", Stuart Russel, Peter Norvig, PHI/ Pearson Education, Second Edition.
2. "Artificial Neural Networks", B. Yagna Narayana, PHI.

REFERENCE BOOKS:

1. "Artificial Intelligence", E. Rich and K. Knight, TMH, 2nd Edition.
2. "Artificial Intelligence and Expert Systems", Patterson, PHI.
3. "Expert Systems: Principles and Programming", Giarrantana-Riley, Thomson, Fourth Edition.
4. "PROLOG Programming for Artificial Intelligence", Ivan Bratka, Pearson Education, Third Edition.
5. "Neural Networks", Simon Haykin, PHI.
6. "Artificial Intelligence", Patrick Henry Winston, Pearson Edition, 3rd Edition.

Course Code	SOFTWARE ENGINEERING & OOAD		L	T	P	C
21A050407	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- The students will have a broad understanding of the discipline of software engineering and its application to the development of and management of software systems.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Knowledge of basic SW engineering methods and practices, and their appropriate application; general understanding of software process models such as the waterfall and evolutionary models. understanding of the role of project management including planning, scheduling, risk management, etc.

CO2: Understanding of software requirements and the SRS document. Understanding of different software architectural styles.

CO3: Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

CO4: Understanding of software testing approaches such as unit testing and integration testing. Understanding of software evolution and related issues such as version management. Understanding on quality control and how to ensure good quality software.

CO5: Understanding of some ethical and professional issues that are important for software engineers. Development of significant teamwork and project-based experience

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO5	2	3	2	1		-	-	-	-	-	-	-	-	2

UNIT- I (12 Hrs)

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize the basic issues in commercial software development. (L3)
- Summarize software lifecycle models. (L5)
- Infer Workout project cost estimates using COCOMO and schedules using PERT and GANTT charts (L3)

UNIT- II (12 Hrs)

Requirements Engineering: Software Requirements, Requirements engineering Process, Requirement's elicitation, Requirements Analysis, Structured Analysis, Data Oriented Analysis, Object oriented Analysis, Prototyping Analysis, Requirements Specification, Requirements Validation, requirement Management.

Learning Outcomes: At the end of this unit, students should be able to

- Identify basic issues in software requirements analysis and specification. (L3)
- Develop SRS document for sample problems using IEEE 830 format. (L5)
- Develop algebraic and axiomatic specifications for simple problems. (L6)

UNIT- III (12 Hrs)

Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Design Methodologies, Structured Design, Object-Oriented Design: Object oriented Analysis and Design Principles. UML Diagrams, Basic Behavioural Modelling: Interactions, Interaction diagrams. Case Study: The Unified Library application.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in software design. (L3)
- Apply the structured, object-oriented analysis and design (SA/SD) technique. (L5)
- Recognize the basic issues in user interface design. (L4)

UNIT- IV (12 Hrs)

Implementation: Coding Principles, Coding Process, Code verification, Code documentation Software Testing: Testing Fundamentals, Test Planning, Black Box Testing, White Box Testing, Levels of Testing, Usability Testing, Regression testing, Debugging approaches.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in coding practice. (L3)
- Recognize the basic issues in software testing. (L5)
- Design test cases for black box and white box testing. (L6)

UNIT- V (11 Hrs)

Software Project Management: Project Management Essentials, what is Project management, Software Configuration Management. Project Planning and Estimation: Project Planning activities, Software Metrics and measurements, Project Size Estimation, Effort Estimation Techniques

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in Software Project Management. (L3)
- Learn and practice project planning activities. (L5)
- Design and develop software metrics and Estimations. (L6)

TEXTBOOKS:

1. "Fundamentals of Software Engineering", Rajib Mall, PHI, 5th Edition, 2018.
2. "Software Engineering- Practioner Approach", Pressman R, McGraw Hill.
3. "Fundamentals of Object-Oriented Design in UML", Meilir Page-Jones, Pearson Education.

REFERENCE BOOKS:

1. "Software Engineering", Somerville, Pearson
2. "Software Engineering Concepts", Richard Fairley, Tata McGraw Hill.
3. "An integrated approach to Software Engineering", Jalote Pankaj, Narosa

Course Code	COMPUTER NETWORKS		L	T	P	C
21A050408	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Familiarize with the applications of Internet
- Explore the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Elucidate the design issues for a computer network

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Identify the software and hardware components of a Computer network (L3)
CO2: Develop new routing, and congestion control algorithms (L3)
CO3: Assess critically the existing routing protocols (L5)
CO4: Explain the functionality of each layer of a computer network (L2)
CO5: Choose the appropriate transport protocol based on the application requirements (L3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT–I (8 Hrs)

Computer Networks and the Internet: What is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models, Networks under attack, History of Computer Networking and the Internet

Learning Outcomes: At the end of this unit, students should be able to

- Enumerate the hardware components of a computer network (L1)
- List the layers of a Computer Network (L1)
- Identify the performance metrics of a computer network (L3)

UNIT–II (12 Hrs)

Application Layer Principles of Network Applications, The web and HTTP, File transfer: FTP, Electronic mail in the internet, DNS-The Internet's Directory Service, Peer-to-Peer Applications

Learning outcomes: At the end of this unit, students should be able to

- Design new applications of a computer network (L6)
- Analyze the application protocols (L4)
- Extend the existing applications (L2)

UNIT–III (14 Hrs)

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, Connectionless Transport: UDP, Principles of Reliable Data transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control

Learning outcomes: At the end of this unit, students should be able to

- Design Congestion control algorithms (L6)
- Select the appropriate transport protocol for an application (L3)
- Identify the transport layer services (L2)

UNIT–IV (12 Hrs)

The Network Layer: Introduction, Virtual Circuit and Datagram Networks, The Internet Protocol (IP): Forwarding and Addressing in the Internet, Routing Algorithms, Routing in the Internet, Broadcast and Multicast Routing

Learning outcomes: At the end of this unit, students should be able to

- Compare routing algorithms (L4)
- Design routing algorithms (L6)
- Extend the existing routing protocols (L2)

UNIT–V (12 Hrs)

The Layer: Links, Access Networks, and LANs Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request

Learning outcomes: At the end of this unit, students should be able to

- Compare medium access protocols (L4)
- Classify the computer networks (L2)
- Design a Data Centre for an organization (L6)

TEXTBOOKS:

1. “Computer Networking: A Top-Down Approach”, James F. Kurose, Keith W. Ross, Pearson, 6^{th} edition, 2019.

REFERENCE BOOKS:

1. "Data communications and Networking", Forouzan, McGraw Hill Publication, 5th Edition.
2. "Computer Networks", Andrew S. Tanenbaum", David J. Wetherall, Pearson, 5th Edition.
3. "Networks for Computer Scientists and Engineers", Youlu Zheng, Shakil Akthar, Oxford Publishers, 2016.

Course Code	OPERATING SYSTEMS		L	T	P	C
21A050409	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Understand basic concepts and functions of operating systems
- Understand the processes, threads and scheduling algorithms.
- Provide good insight on various memory management techniques
- Expose the students with different techniques of handling deadlocks
- Explore the concept of file-system and its implementation issues
- Familiarize with the basics of Linux operating system
- Implement various schemes for achieving system protection and security

COURSE OUTCOMES:

At the end of this course students will be able to:

CO1: Realize how applications interact with the operating system. Analyze the functioning of a kernel in an Operating system. **(K3)**

CO2: Summarize resource management in operating systems. Analyze various scheduling algorithms **(K2)**

CO3: Examine concurrency mechanism in Operating Systems. Apply memory management techniques in design of operating systems **(K4)**

CO4: Understand the functionality of file system. Compare and contrast memory management techniques. **(K2)**

CO5: Understand the deadlock prevention and avoidance. Perform administrative tasks on Linux based systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT-I (8 Hrs)

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

Learning Outcomes: At the end of this unit, students should be able to

- Identify major components of operating systems (L2)
- Understand the types of computing environments (L2)
- Explore several open-source operating systems (L3)
- Recognize operating system services to users, processes and other systems (L3)

<u>UNIT-II</u> (12 Hrs)

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples.

Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers' problem, Readers and writers problem.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance, features of a process and methods of communication between processes. (L2)
- Improving CPU utilization through multi programming and multithreaded programming (L3)
- Examine several classical synchronization problems (L3)

<u>UNIT-III</u> (12 Hrs)

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the various techniques of allocating memory to processes (L3)
- Summarize how paging works in contemporary computer systems (L3)
- Understanding the benefits of virtual memory systems. (L2)

<u>UNIT-IV</u> (14 Hrs)

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Investigate methods for preventing/avoiding deadlocks (L3)
- Examine file systems and its interface in various operating systems (L2)
- Analyze different disk scheduling algorithms (L3)

<u>UNIT-V</u> (14 Hrs)

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Infer various schemes available for achieving system protection. (L2)
- Acquiring knowledge about various countermeasures to security attacks (L3)
- Outline protection and security in Linux and Microsoft Windows. (L2)

<u>TEXTBOOKS:</u>

1. "Operating System Concepts", Silberschatz A, Galvin P B, and Gagne G, Wiley, 9th edition, 2016.
2. "Modern Operating Systems", Tanenbaum A S, Pearson Education, 3rd edition, 2008.

<u>REFERENCE BOOKS:</u>

1. "Operating Systems Design and Implementation", Tanenbaum A S, Woodhull A S, PHI, 3rd edition, 2006.
2. "Operating Systems A Concept Based Approach", Dhamdhere D M, Tata McGraw-Hill, 3rd edition, 2012.
3. "Operating Systems -Internals and Design Principles", Stallings W, Pearson Education, 6th edition, 2009
4. "Operating Systems", Nutt G, Pearson Education, 3rd edition, 2004

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all branches)		L	T	P	C
21A110203			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To know the various types of Market Structures & pricing methods and its strategies.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Analyse the consumer behaviour with regard to their product or services and measure demand of a particular product or services by applying various methods in given situation

CO2: Determine Break Even Point (BEP) of an enterprise Assess the cost behaviour, costs useful for managerial decision making

CO3: Determine the price of a product or services in given market condition

CO4: Analyze the financial position by using different types of ratios and interpret the financial accounting

CO5: Evaluate the investment proposals under payback period, ARR, IRR, NPV & PI methods

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT- I (11 Hrs)

Introduction to Managerial Economics and Demand Analysis: Managerial Economics– Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand- Demand Forecasting- Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Learning Outcomes: At the end of this unit, students should be able to

- Know the nature and scope of Managerial Economics and its importance. (L1)
- Understand the concept of demand and its determinants. (L2)
- Analyse the elasticity and degree of elasticity. (L4)
- Evaluate demand forecasting methods. (L5)
- Design the process of demand estimation for different types of demand. (L6)

UNIT- II (10 Hrs)

Theory of Production and Cost Analysis:

Production Function – Short-run and Long-run Production Function -Isoquants and Iso costs, MRTS –Least cost combination of Inputs, Cobb-Douglas Production Function - Laws of Returns – Internal and External Economies of scale – **Cost & Break-Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA)–Determination of Break-Even Point (Simple Problems)-Managerial significance of Break-Even Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, Input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)
- Develop Profit appropriation for different levels of business activity. (L6)

UNIT- III (11 Hrs)

Introduction to Markets and New Economic Environment:

Market structures Types of Markets-Perfect and Imperfect Competition- Features of Perfect Competition– Monopoly -Monopolistic Competition –Oligopoly-Price-Output Determination-Pricing Methods and Strategies- Forms of Business Organizations - Sole Proprietorship - Partnership – Joint Stock Companies-Public Sector Enterprises - New economic Environment - **Economic Liberalization – Privatization – Globalization.**

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know the production function, input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)

UNIT- IV (10 Hrs)

Capital and Capital Budgeting: Concept of Capital-Significance-Types of Capital-Components of Working Capital - Sources of Short-term and Long-term Capital -Estimating Working capital requirements-**Capital Budgeting**–Features of Capital Budgeting Proposals –

Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept of Capital Budgeting and its importance in business (L1)
- Contrast and compare different investment appraisal methods. (L4)
- Analyse the process of selection of investment alternative using different appraisal methods. (L4)
- Evaluate methods of Capital budgeting techniques. (L5)
- Design different investment appraisals and make wise investments. (L6)

UNIT–V (10 Hours)

Introduction to Financial Accounting and Analysis: Financial Accounting – Concept – Emerging need and Importance - Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet (with simple adjustments). ***Financial Analysis*** - Ratios- Liquidity, Leverage, Profitability and Activity Ratios (Simple Problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept and convention and significance of accounting. (L1)
- Apply the fundamental knowledge of accounting while posting the Journal entries. (L3)
- Analyze the process and preparation of Financial Accounts and Financial Ratios. (L4)
- Evaluate the Financial performance of an enterprise by using financial statements. (L5)

TEXTBOOKS:

1. "Managerial Economics", Varshney & Maheswari, S. Chand, 2013.
2. "Managerial Economics and Financial Analysis", Aryasri, MGH, 4th edition, 2019

REFERENCE BOOKS:

1. "Managerial economics", Ahuja HL, S. Chand, 3rd edition, 2013.
2. "Managerial Economics and Financial Analysis", S. A. Siddiqui and A. S. Siddiqui, New Age International, 2013.
3. "Principles of Business Economics", Joseph G. Nellis and David Parker, Pearson, 2nd edition, New Delhi.
4. "Managerial Economics in a Global Economy", Dominick Salvatore, Cengage Learning, 2013.

Course Code	ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS LAB		L	T	P	C
21A310404			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To understand the working concepts of training and testing data using candidate elimination, ID3 algorithms.
- To understand the practical concepts of ANN's by using Backpropagation concepts.
- To understand and calculate the accuracy of Bayesian networks classifiers.
- To apply and compare the EM algorithm and K-Means algorithms in terms of performance.
- To understand the Regression concepts.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the implementation procedures for the machine learning algorithms.
CO2: Design Java/Python programs for various Learning algorithms.
CO3: Apply appropriate data sets to the Machine Learning algorithms.
CO4: Identify and apply Machine Learning algorithms to solve real world problems.
CO5: Apply back propagation algorithm using different datasets.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

LAB EXPERIMENTS:

1. Implement and demonstrate FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Note:

- The programs can be implemented in either JAVA or Python.
- For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
- Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Course Code	SOFTWARE ENGINEERING & OOAD LAB		L	T	P	C
21A050411	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To Learn and implement the fundamental concepts of software Engineering.
- To explore functional and non-functional requirements through SRS.
- To practice the various design diagrams through appropriate tool.
- To learn to implement various software testing strategies.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Demonstrate the basic concepts of Software Engineering.
CO2: Identify basic issues in software requirements analysis and specification
CO3: Apply the structured, object-oriented analysis and design (SA/SD) technique.
CO4: Design test cases for black box and white box testing.
CO5: Learn and practice project planning activities.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2

SE LAB Experiments List

Week-1

Draw the Work Breakdown Structure for the system to be automated

Week-2

Using COCOMO model estimate effort.

Week-3

a) Calculate effort using FP oriented estimation model.
b) Analyze the Risk related to the project and prepare RMMM pla

Week-4

Develop Time-line chart and project table using PERT or CPM project scheduling methods.

Week-5

Draw E-R diagrams, and DFD for the project.
Design of Test cases based on requirements and design.

Week-6

Test a piece of code which executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.

Week-7

a) Test the percentage of code to be tested by unit test using any code coverage tools
b) Write C/C++/Java/Python program for classifying the various types of coupling.

Week-8

a) Write a C/C++/Java/Python program for classifying the various types of cohesion.
b) Write a C/C++/Java/Python program for object-oriented metrics for design proposed Chidamber and kremer. (Popularly called as CK metrics)

OOAD LAB Experiments List

Take three case studies:

- Customer Support System (in the Object-Oriented Analysis & Design with the Unified Process by Satzinger, Jackson & Burd Cengage Learning)
- Point-Of-Sale Terminal (in Larman textbook)
- Library Management System (in the reference book no. 2 i.e., UML toolkit)

Week-9

Familiarization with Rational Rose or *UML

Week-10

For each case study:
a) Identify and analyse events
b) Identify Use cases

Week-11

For each case study:
a) Develop event table
b) Identify & analyse domain classes

Week-12

For each case study:

a) Represent use cases and a domain class diagram using Rational Rose

b) Develop CRUD matrix to represent relationships between use cases and problem domain classes

<table>
<tr><td>Course Code</td><td rowspan="2">COMPUTER NETWORKS & OPERATING SYSTEMS LAB
(Common to CSE, CSE-AI, AIML, CSE-IOT)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A050412</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="3">IV</td></tr>
</table>

COURSE OBJECTIVES:

- To understand the working of character and bit stuffing
- To understand the Dijkstra's algorithm and its performance
- To analyze the performance of DES encryption algorithms
- To understand CPU scheduling algorithms and page replacement algorithms

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand how data is transmitted and checking of errors. **(K2)**

CO2: Understand Inter process communication including shared memory, pipes and messages **(K2)**

CO3: Simulate CPU Scheduling Algorithms. (FCFS, RR, SJF, Priority, Multilevel Queuing) **(K6)**

CO4: Simulate Banker's Algorithm for Deadlock Avoidance, Prevention Program for FIFO, LRU, and OPTIMAL page replacement algorithm. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2

PART-A

Week 1

Implement the data link layer framing methods such as character, character stuffing and bit stuffing.

Week 2

Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.

Week 3

Implement Dijkstra 's algorithm to compute the Shortest path thru a graph.

Week 4

a) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

b) Take an example subnet of hosts. Obtain broadcast tree for it.

Week 5

a) Take a 64-bit playing text and encrypt the same using DES algorithm.

b) Write a program to break the above DES coding

Week 6

Using RSA algorithm Encrypt a text data and Decrypt the same.

PART-B

Week7

Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority

Week 8

Simulate all file allocation strategies a) Sequential b) Indexed c) Linked

Week 9

Simulate MVT and MFT

Week 10

Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG

Week 11

a) Simulate Bankers Algorithm for Dead Lock Avoidance

b) Simulate Bankers Algorithm for Dead Lock Prevention

Week 12

Simulate all page replacement algorithms a) FIFO b) LRU c) LFU Etc. …

Week 13

a) Simulate Paging Technique of memory management.

b) Experiments on fork, shared memory and semaphores

TEXTBOOKS:

1. "Introduction to Data Communications and Networking", Behrouz Forouzan, Tata McGraw Hill, 2015, 5th Edition.
2. "Data and Computer Communications", Stallings, PHI, 2015, 10th Edition.

REFERENCE BOOKS:

1. "Data Communication", William Schewber, McGraw Hill, 1987.
2. "Computer Networks", Tanenbaum, PHI, 5th Edition, 2011.
3. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, John Wiley, Eight Edition
4. "Operating Systems: Internals and Design Principles", Stallings, Pearson Education, Sixth Edition, 2009.
5. "Modern Operating Systems", Andrew S Tanenbaum, PHI, Second Edition.

ONLINE LEARNING RESOURCES:

1. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
2. http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm
3. http://iit.qau.edu.pk/books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
4. http://www.networkdictionary.com/protocols/osimodel.php

Course Code	ADVANCED JAVA (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050703			1	0	2	0
Pre-requisite	C Programming & Data Structures	Semester	IV			

COURSE OBJECTIVES:

- The course is designed to provide programming fundamentals using JAVA

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Implement object-oriented programming concepts
CO2: Use and create package and interfaces in a java program.
CO3: Understanding of advance website development tools.
CO4: Use Graphical user interface in java program.
CO5: Creates applets.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	2	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	2	-	-	-	-	-	3	3	-	2

Topics to be covered

1. **Introduction of OOPs:** Summarized overview of Object-Oriented programming Technique.

2. **Class and its objects:** Define class and its object, Constructor, types of Constructors, Default Constructor, method over loading, constructor overloading.

3. **Inheritance:** Define inheritance and its type. Constructor in inheritance, super keyword, method overriding.

4. **Package and interface:** Define Package, how to use it, how to access multiple inheritance using interface, dynamic binding

5. **Variables and Inner Classes:** Types of variables, use of static keyword, Inner classes and its importance.

6. **Exception Handling:** Define Exception, how to handle exception, checked and unchecked exception, custom exception, try, catch and finally keywords.

7. **Java I/O:** How to take input from different devices. Hierarchy of java io class.

8. **String:** String methods, StringBuffer class and its methods.

9. **Multithreading:** Creating thread and running it, Multiple Thread acting on single object, Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread.

10. **applets:** Defining the applet and Applet class, life cycle of applets, Font class, Graphics.

11. **Event Handling:** Define Event and its class, Listener, Adapter, MouseListener, MouseMotionListener, KeyListener.

12. **Swing and its Component Layout:** Swing components and Container, different layout, FlowLayout, BorderLayout, GridLayout.

Experiments List

Week 1

Develop a Java Program to implement the concept OOP

Week 2

Develop a Java Program to implement the concept of Inheritance

Week 3

Develop a Java Program to implement the Packages & Interfaces

Week 4

Develop a Java Program to implement Exception handling

Week 5

Develop a Java Program to implement the concept of Java I/O

Week 6

Develop a Java Program to demonstrate Text File Reading and Writing

Week 7
Develop a Java Program to demonstrate the Strings handling

Week 8
Develop a Java Program to implement the concept Multithreading

Week 9
Develop a Java Program to implement the concept of applet

Week 10
Develop a Java Program to implement Event Handling

Week 11
Develop a Java Program to implement a Simple Calculator

Week 12
Develop a Java Program to demonstrate Swing and its Component Layout

REFERENCE BOOKS:

1. "SCJP Sun Certified Programmer", Kathy Sierra and Bert Bates
2. "The Complete Reference", TMH.
3. "Java SE8 for Programmers", Paul Deitel and Harvey Deitel, Deitel Developer Series, 3rd Edition
4. www.tutorialspoint.com/java/
5. www.javatpoint.com/java-tutorial
6. www.udemy.com/java-tutorial/

Course Code	THEORY OF COMPUTATION		L	T	P	C
21A050413	(Common to CSE, CSE-AI, AIML)		**3**	**0**	**0**	**3**
Pre-requisite	Mathematical Foundations of Computer Science	Semester	V			

COURSE OBJECTIVES:

- To introduce languages, grammar, and computational models.
- To explain the Context Free Grammars.
- To enable the students to use Turing machines.
- To demonstrate decidability and un-decidability for NP-Hard problems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Finite Automata and its applications. **(K2)**
CO2: Understand Regular Expressions and its applications. **(K2)**
CO3: Understand Context Free Grammar and its applications. **(K2)**
CO4: Understand Push-Down Automata and its applications. **(K2)**
CO5: Design Turing Machines and Understand Decidability and Un-decidability problems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	-	-
CO4	2	2	2	2	2	-	-	-	-	-	-	-	-	-
CO5	1	1	2	1	2	-	-	-	-	-	-	3	-	2

UNIT – I (10 Hrs)

Finite Automata: The Central Concepts of Automata Theory, Finite Automata, Transition Systems, Acceptance of a String by a Finite Automata, DFA, Design of DFAs, NFA, Design of NFAs, Finite Automata with Ɛ-Transition, Conversions and Equivalence Between Ɛ-NFA, NFA and DFA, Minimization of Finite Automata, Equivalence between Two DFAs, Mealy and Moore Machines, Applications and Limitation of Finite Automata.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology in Finite Automata (L2)
- Design Finite Automata (L4)
- Solve basic problems in Finite Automata (L3)

UNIT – II (9 Hrs)

Regular Expressions: Regular Expressions, Regular Sets, Identity Rules, Equivalence of two Regular Expressions, Manipulations of Regular Expressions, Conversions and Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closure Properties, Applications of Regular Expressions, Finite Automata and Regular Grammars, Regular Expressions and Regular Grammars.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology in Regular Expressions. (L2)
- Understand Applications of Regular Expressions (L2)
- Solve basic problems in Regular Expressions (L3)

<u>UNIT – III</u> (9 Hrs)

Context Free Grammars: Formal Languages and Grammars, Chomsky Hierarchy of Languages and its Recognizers, Context-Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, Ɛ-Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of Context Free Grammars (L2)
- Understand applications of Context Free Grammars (L2)
- Solve basic problems in Context Free Grammars (L3)

<u>UNIT – IV</u> (9 Hrs)

Pushdown Automata: Definition, Model, Graphical Notation, Instantaneous Description Language, Acceptance of pushdown Automata, Design of Pushdown Automata, Deterministic and Non-Deterministic Pushdown Automata, Conversions and Equivalence between Pushdown Automata and Context Free Grammars, Two Stack Pushdown Automata, Application of Pushdown Automata

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of Push Down Automata (L2)
- Design Push Down Automata (L6)
- Solve basic problems in Push Down Automata (L3)

<u>UNIT – V</u> (8 Hrs)

Turing Machines: Definition, Model, Representation of Turing Machines-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a Turing Machine, Design of Turing Machines, Techniques for Turing Machine Construction, Types of Turing Machines, Church's Thesis, Universal Turing Machine, Restricted Turing Machine.

Decidable and Un-decidable Problems: P, NP, NP-Hard and NP-Complete Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology in Turing Machines (L2)

- Design Turing Machines (L4)
- Understand Decidable and Un-decidable Problems (L2)

TEXTBOOKS:

1. "Introduction to Automata Theory, Languages and Computation", J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008.
2. "Theory of Computer Science-Automata, Languages and Computation", K. L. P. Mishra and N. Chandrasekaran, 3rd Edition, PHI, 2007.

REFERENCE BOOKS:

1. "Formal Language and Automata Theory", K. V. N. Sunitha and N. Kalyani, Pearson, 2015.
2. "Introduction to Automata Theory, Formal Languages and Computation", Shyamalendu Kandar, Pearson, 2013.
3. "Theory of Computation", V. Kulkarni, Oxford University Press, 2013.
4. "Theory of Automata, Languages and Computation", Rajendra Kumar, McGraw Hill, 2014.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106106049/
2. https://nptel.ac.in/courses/106104028

Course Code	SOFTWARE TESTING		L	T	P	C
21A050414	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Software Engineering & OOAD	Semester	V			

COURSE OBJECTIVES:

- To understand what is testing? and Software development model.
- To describe different approaches to Testing and testing methodologies.
- To demonstrate how to write and execute test plans
- To illustrate the basic concepts of automation testing
- To discuss about Test NG and other important concepts in automation testing.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Understand the basic concepts of testing and SDLC Models. **(K2)**
CO2: Examine STLC and different types of testing and defects. **(K3)**
CO3: Analyze automation testing and its elements and time functions. **(K4)**
CO4: Demonstrate different Popups in automation testing. **(K3)**
CO5: Analyze various Test NG Frameworks. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Manual Testing: Introduction, Error, Defect, Bug, Verification, Validation. Testing: Types of Testing, White box and Black box Testing. Software Development Life Cycle: Introduction to Software Development Life Cycle, Models for SDLC, Metrics for Projects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain types of testing, verification and validation concepts. (L2)
- Describe about Software Development Life Cycle. (L2)

UNIT – II (9 Hrs)

Software Testing Life Cycle: Basic Concepts of Software Testing Life Cycle, Testing Methodologies, Test Plans, Test Cases, Test Executions and Defect Reports. **Defects:** Types of Defects, Defect Life Cycle, Levels vs Builds, Priority and Severity. **Types of Testing:** Functionality Testing, Security Testing, Smoke Testing, Sanity Testing, Adhoc Testing, Exploratory Testing, Load Testing, Stress Testing, Regression Testing, Retesting.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about Software Testing Life Cycle. (L2)
- Examine various types of Testing and Defects. (L3)

UNIT – III (10 Hrs)

Automation Testing: Introduction to Selenium, Components in Selenium, Installation Process, Cross Browser, Parallel Testing, Web Driver Methods and Locators.

Working on the Elements: Links, Dropdown, Radio Buttons, Check Boxes, Web Tables, Actions. **Time Functions:** Implicit, Explicit, Page Load Functions, Scroll Functions.

Learning Outcomes*:* Student should be able to

- Analyze basic components in selenium (L4)
- Illustrate about different elements and time functions in selenium. (L3)

UNIT – IV (10 Hrs)

Working On Popups: Alerts, Prompts, Confirmation, Working on Frames and Windows, Introduction to Test NG Designs, Annotations in TestNG. Apache POI Jar Files 3.17 for Reading, Writing Excel Files. Page Object Model-Property List.

Learning Outcomes*:* Student should be able *to*

- Understand the popups in automation testing. (L2)
- Illustrate about TestNG Designs. (L3)

UNIT – V (11 Hrs)

Test NG Frameworks: Framework Designing Structure, Keyword Framework, Data Driven Framework, Linear Framework, Modular Framework, Hybrid Framework. Working on Maven Project – Creating Extent Reports, Basics of Github and Jenkins.

Learning Outcomes*:* Student should be able to

- Explain various kinds of Test NG Frameworks (L3)
- Describes Marven projects, Github and Jenkins. (L2)

TEXTBOOKS:

1. “Software Testing: Principles and Practices”, Srinivasan Desikan, Gopalaswamy Ramesh, 1st Edition, Pearson Education.
2. “Software Testing: Principles and Practices”, Naresh Chauhan, 2nd Edition, Oxford University Press

REFERENCE BOOKS:

1. “Software testing techniques”, Boris Beizer, Dreamtech, 2nd Edition, 2002.
2. “The craft of software testing”, Brian Marick, Pearson Education.
3. “Software Testing”, Yogesh Singh, Cambridge
4. “Software Testing”, P.C. Jorgensen , 3rd Edition, Aurbach Publications (Dist.by SPD).

Course Code	MACHINE LEARNING		L	T	P	C
21A050430	(Common to CSE, CSE-AI, AIML)		3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand basic concepts of Machine Learning
- To study different learning algorithms
- To illustrate evaluation of learning algorithms
- To gain knowledge on various machine learning algorithms and apply the same on real time data extracted from confined sources.
- To familiarize the students with Python programming packages pertaining to Machine Learning.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts and paradigms of machine learning. **(K2)**
CO2: Identify machine learning techniques suitable for a given problem **(K2)**
CO3: Apply the classification models on discrete data and analyze the efficiency. **(K3)**
CO4: Apply the regression models on continuous data and analyze the efficiency. **(K3)**
CO5: Apply clustering algorithms over the data with appropriate pre-processing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Introduction to Machine Learning & Preparing to Model: Introduction, What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning.

Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic idea of Machine Learning (L3)
- Prepare a model based on the real time requirement(L4)
- Describe the data pre-processing techniques (L2)

UNIT – II (9 Hrs)

Modelling and Evaluation &Basics of Feature Engineering: Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model.

Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection

Learning Outcomes: At the end of this unit, students should be able to

- Select a best model for solving the real time problem (L2)
- Evaluate the performance of a model (L6)

UNIT – III (9 Hrs)

Bayesian Concept Learning: Classification - Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network.

Supervised Learning: Classification - Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms-*k*-Nearest Neighbour (*k*NN), Decision tree, Random forest model, Support vector machines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic terminology of supervised learning (L3)
- Apply classification model for solving the problem (L3)
- Apply Bayesian belief network for solving the real time application (L3)

UNIT – IV (9 Hrs)

Supervised Learning: Regression - Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the difference between simple, multiple and polynomial regression (L3)
- Facilitate efficient utilization polynomial regression (L6)
- Apply regression algorithms for solving the real time application(L3)

UNIT – V (9 Hrs)

Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods,

K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods- DBSCAN Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules

***Learning Outcomes**:* At the end of this unit, students should be able to

- Describe the different types of clustering techniques (L2)
- Find the pattern using association rule (L3)
- Apply clustering algorithms for solving the real time application (L3)

TEXTBOOKS:

1. "Machine Learning", SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.
2. "Machine Learning", Tom Mitchell, McGraw Hill, 1997.

REFERENCE BOOKS:

1. "Introduction to Machine Learning", Ethern Alpaydin, MIT Press, 2004.
2. "Machine Learning -An Algorithmic Perspective", Stephen Marsland, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2nd Edition,2014.
3. "Introduction to Machine Learning with Python: A Guide for Data Scientists", Andreas C. Müller and Sarah Guido, Oreilly.

ONLINE LEARNING RESOURCES:

1. https://www.deeplearning.ai/machine-learning-yearning/
2. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

Course Code	INFORMATION RETRIEVAL SYSTEMS (Common to CSE, CSE-AI, AIML)		L	T	P	C
21A050416			3	0	0	3
Pre-requisite	Data Base Management Systems	Semester	V			

COURSE OBJECTIVES:

- To demonstrate genesis and diversity of information retrieval situations for text and hyper media
- To describe hands-on experience store, and retrieve information from www using semantic approaches.
- To demonstrate the usage of different data/file structures in building computational search engines.
- To analyze the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia
- To analyze ranked retrieval of a very large number of documents with hyperlinks between them
- To demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the objectives of information retrieval systems **(K2)**

CO2: Examine models like vector-space, probabilistic and language models to identify the similarity of query and document. And to understand the method to construct thesauri automatically and manually **(K3)**

CO3: Illustrate natural language systems to build semantic networks for text **(K3)**.

CO4: Examine algorithms used for natural language processing **(K3)**

CO5: Estimate the measures to evaluate the performance of cross language information **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-	-	3	-		
CO2	-	3	2	-	-	-	-	-	-	-	2	-		
CO3	-	3	3	-	-	-	-	-	-	-	2	-		
CO4	2	-	-	3	-	-	-	-	-	-	-	2		
CO5	2	-	3	-	2	-	-	-	-	-	-	2		

UNIT – I (9 Hrs)

Introduction: Retrieval strategies: vector space model, Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language models.

Learning Outcomes: At the end of this unit, students should be able to

- Identify basic theories in information retrieval systems(L3)
- Identify the analysis tools as they apply to information retrieval systems(L2)

UNIT – II (9 Hrs)

Retrieval Utilities: Relevance feedback, clustering, N-grams, Regression analysis, Thesauri.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate search engines;(L4)
- Develop skills in problem solving using systematic approaches;(L3)
- Solve complex problems in groups and develop group work.(L3)

UNIT – III (9 Hrs)

Retrieval utilities: Semantic networks, parsing Cross –Language: Information Retrieval: Introduction, Crossing the Language barrier

Learning Outcomes: At the end of this unit, students should be able to

- Analyze performance of retrieval systems when dealing with unmanaged data sources (L4)
- Implement retrieval systems for web search tasks. (L3)
- Understand and apply the basic concepts of information retrieval (L4)

UNIT – IV (9 Hrs)

Efficiency: Inverted Index, Query processing, Signature files, Duplicate document detection.

Learning Outcomes: At the end of this unit, students should be able to

- Understand and apply the basic concepts of information retrieval; (L4)
- Appraise the limitations of different information retrieval techniques;(L4)
- Write programs to implement search engines;(L3)

UNIT – V (9 Hrs)

Integrating structured data and text. A historical progression, Information retrieval as relational application, Semi Structured search using a relational schema. Distributed Information Retrieval: A theoretical Model of distributed retrieval, web search

Learning Outcomes: At the end of this unit, students should be able to

- Analyze to research, understand and implement computer programs in the areas related to algorithms (L4)
- To estimate system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity (L5)

TEXTBOOKS:

1. "Information Retrieval Data Structures and Algorithms", W.B. Frakes, Ricardo Baeza-Yates, Prentice Hall, 1992.
2. "Modern Information Retrieval", Yates, Pearson Education.
3. "Information Storage & Retrieval", Robert Korfhage, John Wiley & Sons.

REFERENCE BOOKS:

1. "Information Retrieval Systems: Theory and Implementation", Kowalski, Gerald, Mark T Maybury, Kluwer Academic Press, 1997.
2. "Information retrieval Algorithms and Heuristics", Springer, 2nd Edition.

Course Code	**SOFTWARE PROJECT MANAGEMENT**		**L**	**T**	**P**	**C**
21A050425	(Common to CSE, CSE-AI, AIML)		**3**	**0**	**0**	**3**
Pre-requisite	Software Engineering	Semester	V			

COURSE OBJECTIVES:

- To understand the specific roles within a software organization as related to project and process management
- To learn the principles, techniques, methods & tools for model-based management of software projects, assurance of product quality and process adherence, as well as experience-based creation & improvement of models
- To understand the basic infrastructure competences like process modelling and measurement
- To analyse the basic steps of project planning, project management, quality assurance, and process management and their relationships

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop the model from the conventional software product to the modern **(K3)**

CO2: Apply, analyse, design and develop the software project and design various estimation levels of cost and effort **(K4)**

CO3: Sketch various artifacts sets for better understanding of software development **(K3)**

CO4: Compare and differentiate organization structures and project structures **(K4)**

CO5: Acquire the knowledge of managing, economics for conventional, modern and future software projects **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	2	-	-	-	-	-	-	-	2	-	3	-
CO2	2	3	2	-	2	-	-	-	-	-	-	-	3	2
CO3	-	-	-	-	2	-	-	-	1	-	-	-	-	-
CO4	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	1	-	-	2	-	3	2

UNIT – I (9 Hrs)

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Learning Outcomes: At the end of this unit, the students should be able to

- Prescribe the conventional and evolution of software (L3)
- Comprehend the process of managing software from conventional to modern (L2)
- Describe the evolution of software economics (L2)
- Evaluate budget for any small-scale projects(L4)

- Formulate various cost estimation models (L5)

<u>UNIT – II</u> (10 Hrs)
Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.
The old way and the new: The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process
Learning Outcomes: At the end of this unit, the students should be able to

- Analyze the importance of improving software economics (K4)
- Apply, design & develop the software system by transitioning to an process(K3)

<u>UNIT – III</u> (9 Hrs)
Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.
Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.
Model based software architectures: A Management perspective and technical perspective.
Learning Outcomes: At the end of this unit, the students should be able to

- Categorize different life cycle phases (L4)
- Analyze engineering and production stages(L4)
- Plan and manage projects at each stage of the SDLC(L5)
- Describe various artifact sets (L2)
- Analyze the architecture of a model based software and the process flow (L4)
- Illustrate different process planning strategies (L3)

<u>UNIT – IV</u> (9 Hrs)
Work Flows of the process: Software process workflows, Inter Trans workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Interaction planning process, Pragmatic planning.
Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.
Process Automation: Automation Building Blocks, The Project Environment
Learning Outcomes: At the end of this unit, the students should be able to

- Describe various workflows (L2)
- Summarize the check points of the process (L2)
- Develop the WBS structure of any project (L3)
- Describe the evolution of organization (L2)

UNIT – V (8 Hrs)

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates, Example.

Future Software Project Management: Modern Project Profiles Next generation Software economics, modern Process transitions.

Case Study: The Command Center Processing and Display System-Replacement (CCPDS-R)

Learning Outcomes: At the end of this unit, the students should be able to able to

- Identify seven core metrics (L4)
- Analyze the process automation, process management, and its discriminants (L4)
- Formulate metric automation (L5)
- Establish modern project profile (L2)
- Estimate future technologies of managing software projects (L4)
- Analyze next generation software economics (L4)

TEXTBOOKS:

1. "Software Project Management", Walker Royce, Pearson Education, 2012
2. "Software Project Management", Bob Hughes, Mike Cotterell and Rajib Mall, McGraw Hill Edition, 6th Edition, 2017

REFERENCE BOOKS:

1. "Software Project Management in practice", Pankaj Jalote, Pearson Education, 5th Edition, 2017.
2. "Mastering Software Project Management: Best Practices, Tools and Techniques", Murali K. Chemuturi, Thomas M. Cagley Jr., J. Ross Publishing, 2010
3. "Software Project Management", Sanjay Mohapatra, Cengage Learning, 2011

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/106101061/29

Course Code	MOBILE COMPUTING		L	T	P	C
21A050418	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Computer Networks	Semester	V			

COURSE OBJECTIVES:

- To understand mobile ad hoc networks, design and implementation issues, and available solutions
- To acquire knowledge of sensor networks and their characteristics

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the implementation issues in LANS and PANS of wireless networks.**(K3)**
CO2: Organizing and differentiating various MAC Protocols usage in Adhoc Wireless Networks. **(K4)**
CO3: Analyse Various Routing and Security Protocols in Wireless Networks. **(K4)**
CO4: Classification of QOS and Energy management in Wireless Networks. **(K4)**
CO5: Comparing various Protocols in wireless Sensor Networks and their characteristics. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	-	2
CO4	3	3	3	2	1	-	-	-	-	-	-	-	2	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Wireless LANS and PANS: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.

Wireless Internet: Wireless Internet, Mobile IP, TCP in Wireless Domain, WAP, Optimizing Web over Wireless.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish LANs, WLANs and PANS. (L5)
- Examine about IEEE 802 Standards, Hiperlans and Bluetooth. (L3)

UNIT – II (9 Hrs)

AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, AD Hoc Wireless Internet.

MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention –

Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

Learning Outcomes*:* At the end of this unit, students should be able to

- Illustrate about AD HOC Wireless Networks. (L3)
- Analyse MAC Protocols for Ad Hoc Wireless Networks. (L4)

UNIT – III (9 Hrs)

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding, Flooding: Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

Transport Layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks, Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand basic terminology of Routing Protocols. (L2)
- Explain different classifications of Routing Protocols. (L4)
- Illustrate various Transport Layer and Security Protocols. (L4)

UNIT – IV (9 Hrs)

Quality of Service: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks.

Energy Management: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand the Quality of Service in Ad Hoc Wireless Networks. (L2)
- Explain about Energy Management concepts in Wireless Networks. (L6)

UNIT – V (8 Hrs)

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Describe Wireless Sensor Networks. (L2)
- Explain various MAC Protocols for Wireless Sensor Networks. (L4)

TEXTBOOKS:

1. "Ad Hoc Wireless Networks: Architectures and Protocols", C. Siva Ram Murthy and B. S. Manoj, PHI, 2004.
2. "Wireless Ad-hoc and Sensor Networks: Protocols, Performance and Control", Jagannathan Sarangapani, CRC Press.

REFERENCE BOOKS:

1. "Ad hoc Mobile Wireless Networks", Subir Kumar sarkar, T G Basvaraju, C Puttamadappa, Auerbach Publications, 2012.
2. "Wireless Sensor Networks", C. S. Raghavendra, Krishna M. Sivalingam, Springer, 2004.
3. "Ad-Hoc Mobile Wireless Networks: Protocols & Systems", C.K. Toh, Pearson Education.

Course Code	SOFTWARE TESTING LAB		L	T	P	C
21A050419	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	Object Oriented Programming through Java	Semester	V			

COURSE OBJECTIVES:

- To understand the fundamentals for various testing methodologies.
- To describe the principles and procedures for designing test cases.
- To explore debugging methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the basic testing procedures. **(K2)**
CO2: Formulate test cases and test suites **(K6)**
CO3: Choose Selenium tools to perform testing **(K3)**
CO4: Construct and test simple programs. **(K6)**
CO5: Describe bug tracking **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	-	-	-	-	3	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	2	-	-	-	-	-	-	2	1
CO4	3	-	2	-	-	-	-	-	-	-	-	-	2	-
CO5	-	3	3	-	-	2	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

MANUAL TESTING: (USING C LANGUAGE)

1. Write a ‘C’ program to demonstrate the working of the following constructs:
   a). do…while
   b). while
   c). if …else
   d). switch
   e). for Loops in C language.
2. A program written in c language for matrix multiplication fails “Introspect the causes for its failure and write down the possible reasons for its failure”.
3. Take any system (e.g. ATM system) and study its system specifications and report the various bugs.
4. Write the test cases for any known application (e.g. Banking application)
5. Create a test plan document for any application (e.g. Library Management System).

AUTOMATION TESTING : (using Selenium)

1. Write a script to open google.com and verify that title is Google and also verify that it is redirected to google.co.in.
2. Write a script to open google.co.in using chrome browser (ChromeDriver).
3. Write a script to open google.co.in using internet explorer (InternetExplorerDriver).
4. Write a script to login Next Generation Automation.
5. Write a script to close all the browsers without using quit() method.
6. Write a script to test the cookie creation.
7. Write a script to test the Gmail Login & Logout procedure.
8. Write a script to test the Facebook Account Creation.
9. Write a script to test the Google Cache Selection.
10. Write a script to test the Gmail Composing Dynamically.

TEXTBOOKS:

1. "Software Testing: Principles and Practices", Srinivasan Desikan, Gopalaswamy Ramesh, 1st Edition, Pearson Education.
2. "Software Testing: Principles and Practices", Naresh Chauhan, 2nd Edition, Oxford University Press
3. "Java Complete Reference", Herb Schildt, 9th Edition, Oracle press.

Course Code	MACHINE LEARNING LAB		L	T	P	C
21A310405	(Common to CSE-AI, AIML)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To make use of Datasets in implementing the machine learning algorithms
- To implement the machine learning concepts and algorithms in any suitable language of choice.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the Mathematical and statistical prospective of machine learning algorithms through python programming. **(K2)**

CO2: Appreciate the importance of visualization in the data analytics solution. **(K2)**

CO3: Derive insights using Machine learning algorithms. **(K5)**

CO4: Apply clustering algorithms over the data with appropriate pre-processing. **(K3)**

CO5: Understand and create machine learning models for real time data, appropriate to the given application. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	-	-	3	-	-	-	-	-	-	-	-	1	-
CO4	3	-	-	2	-	-	-	-	-	-	-	-	-	2
CO5	3	-	-	-	-	-	-	-	2	-	-	-	-	2

LIST OF EXPERIMENTS:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypo thesis based on given set of training data samples. Read the training data from a. CSVfile.
2. For a given set of training data examples stored in a. CSVfile, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypo theses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.

5. Write a program to implement then aïve Bayesian classifier for a sample training dataset stored as a .CSV file. Compute the accuracy of the classifier, considering few test datasets.
6. Assuming a set of documents that need to be classified, use then aïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java / Python M Llibrary classes / API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python M Llibrary classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris dataset. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graph1.

PROJECTS:

1. Predicting the Sale price of a house using Linear regression
2. Spam classification using Naïve Bayes algorithm
3. Predict car sale prices using Artificial Neural Networks
4. Predict Stock market trends using LSTM
5. Detecting faces from images

REFERENCE BOOKS:

1. “Python Machine Learning Work book for beginners”, AI Publishing, 2020.

ONLINE LEARNING RESOURCES:

1. https://www.udemy.com/course/machinelearning/
2. https://in.coursera.org/browse/data-science/machine-learning

Course Code	R PROGRAMMING		L	T	P	C
21A310702	(Common to CSE-AI, AIML)		**1**	**0**	**2**	**2**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- How to manipulate data within R and to create simple graphs and charts used in introductory statistics.
- The given data using different distribution functions in R.
- The hypothesis testing and calculate confidence intervals; perform linear regression models for data analysis.
- The relevance and importance of the theory in solving practical problems in the real world.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Install and use R for simple programming tasks. **(K3)**
CO2: Extend the functionality of R by using add-on packages **(K4)**
CO3: Extract data from files and other sources and perform various data manipulation tasks on them. **(K4)**
CO4: Use R Graphics and Tables to visualize results of various statistical operations on data. **(K3)**
CO5: Apply the knowledge of R gained to data Analytics for real-life applications. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	-	-	-	-	3	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	2	-	-	-	-	-	-	2	1
CO4	3	-	2	-	-	-	-	-	-	-	-	-	2	-
CO5	-	3	3	-	-	2	-	-	-	-	-	-	-	2

WEEK-1: INTRODUCTION TO COMPUTING

a. Installation of R
b. The basics of R syntax, workspace
c. Matrices and lists
d. Subsetting
e. System-defined functions; the help system
f. Errors and warnings; coherence of the workspace

WEEK-2: GETTING USED TO R: DESCRIBING DATA

a. Viewing and manipulating Data
b. Plotting data
c. Reading the data from console, file (.csv) local disk and web
d. Working with larger datasets

WEEK-3: SHAPE OF DATA AND DESCRIBING RELATIONSHIPS

a. Tables, charts and plots.
b. Univariate data, measures of central tendency, frequency distributions, variation, and Shape.
c. Multivariate data, relationships between a categorical and a continuous variable,
d. Relationship between two continuous variables – covariance, correlation coefficients, comparing multiple correlations.
e. Visualization methods – categorical and continuous variables, two categorical variables, two continuous variables.

WEEK-4: PROBABILITY DISTRIBUTIONS

a. Sampling from distributions – Binomial distribution, normal distribution
b. tTest, zTest, Chi Square test
c. Density functions
d. Data Visualization using ggplot – Box plot, histograms, scatter plotter, line chart, bar chart, heat maps

WEEK-5: EXPLORATORY DATA ANALYSIS

Demonstrate the range, summary, mean, variance, median, standard deviation, histogram, box plot, scatter plot using population dataset.

WEEK-6: TESTING HYPOTHESES

a. Null hypothesis significance testing
b. Testing the mean of one sample
c. Testing two means

WEEK-7: PREDICTING CONTINUOUS VARIABLES

a. Linear models
b. Simple linear regression
c. Multiple regression
d. Bias-variance trade-off – cross-validation

WEEK-8: CORRELATION

a. How to calculate the correlation between two variables.
b. How to make scatter plots.
c. Use the scatter plot to investigate the relationship between two variables

WEEK-9: TESTS OF HYPOTHESES

a. Perform tests of hypotheses about the mean when the variance is known.
b. Compute the p-value.
c. Explore the connection between the critical region, the test statistic, and the p-value

WEEK-10: ESTIMATING A LINEAR RELATIONSHIP

Demonstration on a Statistical Model for a Linear Relationship

a. Least Squares Estimates
b. The R Function lm
c. Scrutinizing the Residuals

WEEK-11: APPLY-TYPE FUNCTIONS

a. Defining user defined classes and operations, Models and methods in R
b. Customizing the user's environment
c. Conditional statements
d. Loops and iterations

WEEK-12: STATISTICAL FUNCTIONS IN R

a. Write Demonstrate Statistical functions in R
b. Statistical inference, contingency tables, chi-square goodness of fit, regression, generalized linear models, advanced modeling methods.

TEXTBOOKS:

1. "Statistics with R Programming", Sandip Rakshit, McGraw Hill Education, 2018.

REFERENCE BOOKS:

1. "R forData Science", Hadley Wickham, O'Reilly, 1st Edition
2. "An Introduction to Statistical Learning: with Applications in R", Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer Texts in Statistics, 2017.
3. "Statistical Analysis with R for Dummies", Joseph Schmuller, Wiley, 2017.
4. "Statistical Programming in R", K G Srinivasa, G M Siddesh, ChetanShetty, Sowmya B J, Oxford Higher Education, 2017.

ONLINE LEARNING RESOURCES:

1. www.oikostat.ch
2. https://learningstatisticswithr.com/
3. https://www.coursera.org/learn/probability-intro#syllabus
4. https://www.isibang.ac.in/~athreya/psweur/

Course Code	UNIVERSAL HUMAN VALUES (Common to all branches)		L	T	P	C
21A000003			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the significance and need of values in the society. **(K2)**

CO2: Understand the meaning of Harmony in the Self the Co-existence of Self and Body. **(K2)**

CO3: Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society **(K2)**

CO4: Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. **(K3)**

CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-

UNIT – I (9 Hrs)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the significance and need of values in the society. (L2)

UNIT – II (9 Hrs)

Understanding Harmony in the Human Being - Harmony in Myself: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programs to ensure self-regulation and Health.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the meaning of Harmony in the Self the Co-existence of Self and Body. (L2)
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. (L2)

UNIT – III (9 Hrs)

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order

Learning Outcomes: At the end of this unit, students should be able to

- Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society (L2)

UNIT – IV (9 Hrs)

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at all Levels, and the Holistic Perception of Harmony in Existence.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. (L3)

UNIT – V (9 Hrs)

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Learning Outcomes: At the end of this unit, students should be able to

- Identify the scope and characteristics of people friendly and eco-friendly production systems. (L2)

- Develop appropriate technologies and management patterns for above production systems. (L3)
- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. (L3)

TEXTBOOKS:

1. "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

REFERENCE BOOKS:

1. "Jeevan Vidya: Ek Parichaya", A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. "Human Values", A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. "The Story of My Experiments with Truth", Mohandas Karamchand Gandhi
5. "Small is Beautiful", E. FSchumacher.
6. "Slow is Beautiful", Cecile Andrews
7. "Economy of Permanence", J C Kumarappa
8. "Bharat Mein Angreji Raj", Pandit Sunderlal
9. "Rediscovering India", Dharampal,
10. "Hind Swaraj or Indian Home Rule", Mohandas K. Gandhi,
11. "India Wins Freedom", Maulana Abdul Kalam Azad
12. "Vivekananda", Romain Rolland (English)
13. "Gandhi", Romain Rolland (English)

ONLINE LEARNING RESOURCES:

1. http://www.uhv.org.in/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://www.studocu.com/in/document/dr-apj-abdul-kalam-technical-university/universal-human-valuestechnical-communication/uhv-best-notes/31376289

Course Code	DEEP LEARNING (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050432			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To demonstrate the major technology trends driving Deep Learning
- To build, train, and apply fully connected deep neural networks
- To implement efficient (vectorized) neural networks
- To analyse the key parameters and hyper parameters in a neural network's architecture

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the mathematical foundation of neural network. **(K2)**
CO2: Describe the machine learning basics **(K4)**
CO3: Differentiate architecture of deep neural network **(K3)**
CO4: Build a Convolution Neural Network **(K4)**
CO5: Build and train RNN and LSTMs **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms,Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' ule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the tensors, SVD (L3)
- Differentiation between SVD and PCA (L3)
- Understand the different types of pdfs (L4)
- Implementation of Optimization(L2)

UNIT – II (9 Hrs)

Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the validation sets, maximum likely hood (L3)
- Differentiation between Supervised and Unsupervised Learning (L3)
- Implementation of MLP and Solution to XOR problem (L2)

UNIT – III (9 Hrs)

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Constrained Optimization (L3)
- Optimization for Training deep models (L4)
- Implement of Meta Algorithms(L2)

UNIT – IV (9 Hrs)

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the CNN algorithm and its applications in Image Processing (L3)
- Defining the structured outputs (L2)
- Implementation of CNN(L2)

UNIT – V (8 Hrs)

Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence

Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the RNN structures (L3)
- Differentiation between LSTM, Gated RNN (L3)
- Implement Deep Generative Models(L2)

TEXTBOOKS:

1. “Deep Learning”, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2016.
2. “Deep learning: A practitioner's approach”, Josh Patterson and Adam Gibson, O'Reilly Media, First Edition, 2017.

REFERENCE BOOKS:

1. “Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms”, Nikhil Buduma, O’Reilly, Shroff Publishers, 2019.
2. “Deep learning Cook Book, Practical recipes to get started Quickly”, Douwe Osinga, O’Reilly, Shroff Publishers, 2019.

ONLINE LEARNING RESOURCES:

1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf
4. https://www.cse.iitm.ac.in/~miteshk/CS7015.html
5. https://www.deeplearningbook.org
6. https://nptel.ac.in/courses/106105215

Course Code	MOBILE APPLICATION DEVELOPMENT		L	T	P	C
21A050422	(Common to CSE, CSE-IOT, CSE-AI, AIML)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of android operating systems.
- To illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify mobile application development software development tools. **(K3)**
CO2: Analyse various widgets in mobile applications**. (K3)**
CO3: Compare various layouts in mobile application design. **(K3)**
CO4: Utilize multimedia, camera and Location based services in Android App. **(K3)**
CO5: Build mobile application with dialogs and Fragments and Design and develop menus with database in mobile applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	3	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3

UNIT – I (9 Hrs)

Introduction to Android: The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Android architecture. (L3)
- Summarize the various features for Android (L2)

UNIT – II (9 Hrs)

Basic Widgets: Understanding the Role of Android Application Components, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the

User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.

Learning Outcomes*:* At the end of this unit, students should be able to

- Analyse the basic Widgets (L4)
- Discover the Need for Event Handling in different Mobile Applications (L3)
- Choose the controls for the mobile Applications (L3)

UNIT – III (9 Hrs)

Building Blocks for Android Application Design: Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation.

Utilizing Resources and Media: Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video, Displaying Progress with Progress Bar, Using Assets.

Learning Outcomes: At the end of this unit, students should be able to

- Choose the building blocks for Android Application Design (L3)
- Select the resources and media for the mobile Applications (L3)
- Illustrating the mobile design (L4)

UNIT – IV (9 Hrs)

Using Selection widgets and Debugging: Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control, Using the Debugging Tool: Dalvik Debug Monitor Service(DDMS), Debugging Application, Using the Debug Perspective.

Displaying And Fetching Information Using Dialogs and Fragments: What Are Dialogs?, Selecting the Date and Time in One Application, Fragments, Creating Fragments with java Code, Creating Special Fragments

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the debugging process (L3)
- Choose the selection widgets for mobile applications (L3)
- Illustrate Dialogs and Fragments (L4)

UNIT – V (9 Hrs)

Building Menus and Storing Data: Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a

Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar

Using Databases: Using the SQLite Open Helper class, Accessing Databases with the ADB, Creating a Data Entry Form,

Communicating with SMS and Emails: Understanding Broadcast Receivers, Using the Notification System, Sending SMS Messages with Java Code, Receiving SMS Messages, Sending Email, Working With Telephony Manager.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Create Menus and Storing Data (L6)
- Analyse Databases for mobile applications (L4)
- Analyse Communications with SMS and Emails (L4)

TEXTBOOKS:

1. "Android Programming", B.M Harwani, Pearson Education, 2013

REFERENCE BOOKS:

1. "Android application Development for Java Programmers", James C Sheusi, Cengage Learning
2. "Android In Action", W. Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz., Dreamtech.
3. "Professional Android 4 applications development", Reto Meier, Wiley India, 2012.
4. "Beginning Android 4 applications development", Wei Meng Lee, Wiley India,2013
5. "Beginning Android Development: Create Your Own Android", PawPrints Learning Technologies, Apps Today, 2014.
6. "Android Programming: Pushing the Limits", Erik Hellman, John Wiley and sons ltd, 2014.
7. "Introduction to Android Application Development", Joseph Annuzzi, Jr, Lauren Darcey, Addison-Wesley, 4th Edition.

Course Code	CLOUD COMPUTING		L	T	P	C
21A050423	(Common to CSE, CSE-AI, AIML)		**3**	**0**	**0**	**3**
Pre-requisite	Database Management Systems, Python Programming and Data science	Semester	VI			

COURSE OBJECTIVES:

- Define cloud services and models
- Demonstrate design the architecture for new cloud application.
- Explain how to re-architect the existing application for the cloud.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate Fundamentals of Cloud Computing **(K3)**
CO2: Analyze Cloud Services, Platforms and Map Reduce Framework **(K4)**
CO3: Examine the Cloud Application Design and Live Apps **(K3)**
CO4: Analyze Python usage for Cloud Platforms and Django Framework **(K4)**
CO5: Illustrate Cloud Application Development in Python **(K3)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction to Cloud Computing: Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing.

Learning Outcomes: At the end of this unit, students should be able to:

- Outline the Cloud characteristics and models (L2)
- Classify different models, different technologies in cloud (L2)

UNIT – II (9 Hrs)

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and Management Services, Identity and Access Management Services, Open Source Private Cloud Software, Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.

Learning Outcomes: At the end of this unit, students should be able to:

- Summarize the Services and Platform of cloud (L3)
- Demonstrate Hadoop Cluster Setup (L4)

UNIT – III (9 Hrs)

Cloud Application Design: Design Considerations, Reference Architectures, Cloud Application Design Methodologies, Data Storage Approaches,

Multimedia Cloud: Introduction, Case Study: Live Video Streaming App, Streaming Protocols, Case Study: Video Transcoding APP.

Learning Outcomes: At the end of this unit, students should be able to:

- Design and build cloud applications (L3)
- Describe the multimedia cloud. (L2)

UNIT – IV (9 Hrs)

Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure, Python for MapReduce, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.

Learning Outcomes: At the end of this unit, students should be able to:

- Select different cloud services from different vendors (L3)
- Utilize Python language to access cloud services (L4)

UNIT – V (8 Hrs)

Cloud Application Development in Python, Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App, Cloud Application Benchmarking and Tuning, Cloud Security, Cloud Computing for Education.

Learning Outcomes: At the end of this unit, students should be able to:

- Investigate different Cloud applications. (L4)
- Design cloud applications using Python. (L4)

TEXTBOOKS:

1. "Cloud Computing A Hands-on Approach", Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

REFERENCE BOOKS:

1. "Azure in Action", Chris Hay, Brian Prince, Manning Publications, 2010.
2. "Introducing Windows Azure", Henry Li, Apress, 1st Edition, 2009.
3. "Developing Applications for the Cloud on the Microsoft Windows Azure Platform" Matias Woloski, Microsoft Press, 1st Edition, 2010.
4. "Developing with Google App Engine", Eugene Ciurana, Apress, 2009.
5. "Using Google App Engine", Charles Severance, O'Reilly Media, 1st Edition, 2009.

Course Code	SAP		L	T	P	C
21A050417	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Data Base Management Systems	Semester	VI			

COURSE OBJECTIVES:

- To bridge the gap between the Academics and Industries
- To create job ready manpower resource pool with the skills of SAP
- To enhance employability by meeting the skill requirement of industry to address ever changing business needs.
- To build knowledge based Economy with cost effective program for World's best IT Company
- To understand industry best practices supported by SAP ERP – "Be future ready"

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the basic concepts of ERP (Enterprise Resource Planning) & SAP (Systems Applications and Products in Data Processing) **(K3)**

CO2: Analyze the SAP Net-Weaver Architecture for designing ABAP (Advanced Business Application Programming) **(K4)**

CO3: Categorize the various components of SAP & Client Administration **(K4)**

CO4: Solve the general administration and monitoring problems **(K3)**

CO5: Cconnect new versions of SAP like SAP HANA for Cloud Data. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	2	1	-	-	-	-	-	-	-	-	-	2
CO2	2	1	3	3	1	-	-	-	-	-	-	-	-	2
CO3	2	1	3	2	-	-	-	-	-	-	-	-	-	2
CO4	1	-	2	2	1	-	-	-	-	-	-	-	2	-
CO5	2	1	3	3	2	-	-	-	-	-	-	-	2	-

UNIT – I (9 Hrs)

ERP Introduction: ERP and its background, Different types of ERPs, Evolution of SAP, Different versions of SAP, New dimensional components of SAP, Modules of each SAP component.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basics concepts of ERP (L2)
- Understand the evolution and versions of SAP (L2)
- Analyse the various modules of SAP (L3)

UNIT-II (9 Hrs)

SAP Net-Weaver Architecture: NW Introduction, Components of NW & Core Architecture, Application servers, Central Instance, Dialog instance, ABAP and Java Stacks, Message servers, Dispatchers, WPs and the types, System Landscape

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the different components of NW (L3)
- Analyse the architecture of Net-Weaver (L3)
- Understand the ABAP and creating servers (L2)

<u>UNIT – III</u> (9 Hrs)

SAP Components: Core Component and functionality, Modules of SAP components, Roles in SAP application, Basis introduction to SAP technical work flow.

Client Administration: Client Concept, Create clients, Client Export/Import, Copy Logs, Monitoring of Client Copy

Learning Outcomes: At the end of this unit, students should be able to

Understand the components of SAP & Applications (L2)

- Analyse the workflow of SAP (L3)
- Plan the Client Administration like importing and exporting data (L5)

<u>UNIT – IV</u> (9 Hrs)

General Administration: Daily, weekly and monthly monitoring the system health, T-Codes related to System monitoring, Background Jobs administration, Spool architecture and administration, Performance tuning methods and implantation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the General monitoring and administration methods (L2)
- Analyse the spool architecture and administration (L3)
- Applying the performance monitoring methods (L3)

<u>UNIT – V</u> (8 Hrs)

Database administration: Oracle Database concepts, Monitoring Table spaces, SAPDBA/BR Tools, DB Activities and T-Codes, SAP HANA.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the database administration methods (L2)
- Analyse the SAPDBA Tools (L3)
- Comparing latest versions of SAP like SAP HANA (L2)

<u>TEXTBOOKS:</u>

1. “The Beginner’s Guide to sap”, Peter Moxon, SAPPROUK Limited
2. “SAP HANA: An Introduction”, Bjarne Berg, Penny Silvia, Galilio Press, 3rd Edition

<u>REFERENCE BOOKS:</u>

1. “SAP HANA 2.0: An Introduction”, Denys Van Kempen
2. “SAP HANA 2.0 Administration”, Bert Vanstechelman

3. "ABAP Development for SAP HANA (SAP PRESS)", Mohsin Ahmed, Sumit Naik, 1st Edition

Course Code	CRYPTOGRAPHY & NETWORK SECURITY (Common to CSE-AI, AIML)		L	T	P	C
21A310406			3	0	0	3
Pre-requisite	Computer Networks	Semester	VI			

COURSE OBJECTIVES:

- To introduce the basic categories of threats to computers and networks
- To illustrate various cryptographic algorithms.
- To demonstrate public-key cryptosystem.
- To discuss the fundamental ideas of public-key cryptography.
- To explore Web security threats and protection mechanisms

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate Fundamentals of Cryptography **(K3)**
CO2: Analyse Symmetric key Ciphers and algorithms and Asymmetric key Ciphers **(K4)**
CO3: Examine the Message Authentication Algorithms and Hash Functions **(K3)**
CO4: Illustrate algorithms and methods for E-Mail security and IP Security **(K3)**
CO5: Discuss the concepts of Web Security, Virus, Worms and Firewalls **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	-	-	-	-	-	-	-	-	1	1
CO4	3	3	2	3	1	-	-	-	-	-	-	-	-	2
CO5	3	3	3	3	1	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Attacks on Computers and Computer Security: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security

Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

Learning Outcomes: At the end of this unit, students should be able to

- Identify different types of Attacks (L3)
- Interpret various cryptography techniques (L4)
- Distinguish between cryptography and steganography (L4)

UNIT – II (9 Hrs)

Symmetric key Ciphers: Block Cipher principles &Algorithms (DES, AES and Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption function, Key distribution

Asymmetric key Ciphers: Principles of public key cryptosystems, Algorithms (RSA, Diffie-Hellman, ECC), Key Distribution

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate symmetric and asymmetric ciphers (L4)
- Explain the principles of public key cryptography (L2)
- Select the appropriate cryptographic algorithm based on the requirements and applications (L4)

UNIT-III: (9 Hrs)

Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize authentication techniques (L2)
- Apply Hash algorithm for generating Digital signatures (L3)

UNIT-IV: (9 Hrs)

E-Mail Security: Pretty Good Privacy, S/MIME

IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, combining security associations, key management.

Learning Outcomes: At the end of this unit, students should be able to

- Extend security for emails (L2)
- Examine IP security mechanisms (L4)

UNIT-V: (9 Hrs)

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction

Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls

Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections.

Learning Outcomes: At the end of this unit, students should be able to

- Design secure electronic transactions (L4)
- Explain different types of Firewalls (L2)

TEXT BOOKS:

1. "Cryptography and Network Security", William Stallings, Pearson Education, 5th Edition, 2011.
2. "Cryptography and Network Security", Atul Kahate, Mc Graw Hill, 2nd Edition, 2010.
3. "Network Security and Cryptography", Bernard Menezes, CENGAGE Learning, 1st Edition, 2010.

REFERENCE BOOKS:

1. "Cryptography and Network Security", C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition, 2011.
2. "Cryptography and Network Security", Forouzan Mukhopadhyay, McGraw Hill, 2nd Edition, 2010.
3. "Information Security, Principles and Practice", Mark Stamp, Wiley India, 2nd Edition, 2011.

Course Code	BASICS OF INTERNET OF THINGS		L	T	P	C
21A310407	(Common to CSE-AI, AIML)		3	0	0	3
Pre-requisite	Computer Networks	Semester	VI			

COURSE OBJECTIVES:

- To explore the interconnection and integration of the physical world and the cyber space.
- To design & develop IoT Devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the Application areas of IoT **(K2)**
CO2: Understand concepts of IoT network management protocols **(K2)**
CO3: Design and develop Internet of Things application **(K6)**
CO4: Analyze and develop the algorithms required to manage and analyze big data like Hadoop, No Sql MapReduce **(K4)**
CO5: Make use of Zigbee protocol in IoT network **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction to Internet of Things: Introduction, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies. Domain Specific IoTs Introduction, Home Automation, cities, Environment, Retail, Agriculture, Industry, Health & Lifestyle.

Learning Outcomes: At the end of this unit, students should be able to

- Explain IoT architecture. (L3)
- Interpret the design principles that govern connected devices (L2)
- Summarize the roles of various organizations for IoT (L2)

UNIT – II (9 Hrs)

IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT. IoT System Management with NETCONF-YANG: Need for IoT Systems Management, Simple Network Management Protocol (SNMP), Network Operator requirements, NETCONF, YANG, IoT System Management with NETCONF-YANG.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the IoT and M2M (L4)
- Discover the Need for IoT Systems Management (L3)

UNIT – III (9 Hrs)

Developing Internet of Things: Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring.

Case Studies Illustrating IoT Design: Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Choose the IoT Design Methodology for an application (L3)
- Apply modular approach for solving the problem (L3)
- Illustrating IoT Design (L4)

UNIT – IV (10 Hrs)

Advanced Topics: Introduction, Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis.

IEEE 802.15.4: The IEEE 802 committee family of protocols, The physical layer, The Media Access control layer, Uses of 802.15.4, The Future of 802.15.4: 802.15.4e and 802.15.4g.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze big data like Hadoop, NoSql MapReduce (L3)
- Utilize the Internet communication protocols for IoT applications (L3)
- Select which protocol can be used for a specific application (L3)

UNIT – V (10 Hrs)

ZigBee: Development of the standard, ZigBee Architecture, Association, The ZigBee network layer, The ZigBee APS Layer, The ZigBee Devices Object (ZDO) and the ZigBee Device Profile (ZDP), Zigbee Security, The ZigBee Cluster Library (ZCL), ZigBee Applications profiles, The ZigBee Gateway Specifications for network devices.

Learning Outcomes: At the end of this unit, students should be able to

- Explain ZigBee Architecture (L3)
- Analyze ZigBee Applications (L4)

TEXT BOOKS:

1. "Internet of Things: a Hands-on Approach", Arshdeep Bahga and Vijay Madisetti. University Press.
2. "The Internet of Things: key applications and protocols", Oliver Hersent, David Boswarthick and Omar elloumi, Wiley Student Edition.

REFERENCE BOOKS:

1. "Internet of Things: Architecture, Design Principles and Applications", Raj Kamal MC Graw Hill Edition.

Course Code	DEEP LEARNING LAB (Common to CSE-AI, AIML)		L	T	P	C
21A310408			0	0	3	1.5
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the context of Neural networks and deep learning.
- To introduce major Deep learning algorithms, the problem settings and their applications to solve real world problems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the Deep learning algorithms which are more appropriate for various types of learning tasks in various domains **(K1)**

CO2: Implementing Deep learning algorithms and solve real-world problems **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-

LIST OF PROGRAMS:

1. Introduction of Keras.
2. Installing Keras and packages in Keras.
3. Train the model to add two numbers and report the result.
4. Train the model to multiply two matrices and report the result using keras.
5. Train the model to print the prime numbers using Keras
6. Recurrent Neural Network
   a. Numpy implement of a simple recurrent neural network
   b. Create are current layer in keras
   c. Prepare IMDB data for movie review classification problem.
   d. Train the model with embedding and simple RNN layers.
   e. Plot the Results
7. Consider temperature-forecast as one the example for recurrent neural network and implement the following.
   a. Inspect the data of the weather data set
   b. Parsing the data
   c. Plotting the temperature time series
   d. Plottingthefirst10days of the temperature time series

8. Long short-term memory network
   a. Implement LSTM using LSTM layer in keras
   b. Train and evaluate using reversed sequences for IMDB data
   c. Train and evaluate a bidirectional LSTM for IMDB data
9. Train and evaluate a Gated Recurrent Unit based model
   a. By using GRU layer
   b. By adding drop out and recurrent drop out to GRU layer.
   c. Train a bidirectional GRU for temperature prediction data
10. Convolutional Neural Networks
   a. Preparing the IMDB data
   b. Train and evaluate a simple1D convention IMDB Data
   c. Train and evaluate a simple1D convention temperature prediction data
11. Develop a traditional LSTM for sequence classification problem.

PROJECTS:

1. Write a program for Multi label Movie Poster Classification
2. Write a program for Predicting Bike-Sharing patterns

REFERENCES:

1. "Deep Learning (Adaptive Computation and Machine Learning series)", Ian Good fellow, Yoshua Bengio, Aaraon Courville, MIT Press, 2016.

ONLINE LEARNING RESOURCES:

1. rses-dl-course.github.io
2. https://www.geeksforgeeks.org/deep-learning-introduction-to-long-short-term-memory/

Course Code	MOBILE APPLICATION DEVELOPMENT LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050427			**0**	**0**	**3**	**1.5**
Pre-requisite	Object Oriented Programming through Java	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of android operating systems.
- To illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Build a native application using GUI components and Mobile application Development **(K3)**

CO2: To demonstrate their skills of using Android software development tools and construct an application using multimedia **(K3)**

CO3: Explore the android studio IDE, Build mobile application with dialogs and Fragments and design, develop menus with database in mobile applications **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	-	1	2	2	1	1	-	2	3	3
CO2	3	2	2	-	-	1	2	2	1	1	-	2	3	3
CO3	3	2	2	-	-	1	2	2	1	1	-	2	2	3

LIST OF EXPERIMENTS:

1. Setting Up the Development Environment Download & Install the SDK and the SDK Platform Components
2. Create "Hello World" Application Create a new Android Project Run "Hello World" on the Emulator and On a Physical Device Greeting the User.
2. Create Application by Using Widgets Creating the Application by using the Activity class
   (i) onCreate() (ii) onStart() (iii) onResume() (iv) onPause() (v) onStop() (vi) onDestroy() (vii) onRestart()
3. Creating the Application by using Text Edit control.
4. Creating the Application Choosing Options
   (i) CheckBox (ii) RadioButton (iii) RadioGroup (iv) Spinner
5. Create Application by Using Building Blocks for Android Application Design. Design the Application by using
   (i) Linear Layout (ii) Relative Layout (iii) Absolute Layout

6. Create the Application to play the Audio and Video clips.
7. Create Application by Using Building Menus and Storing Data.
8. Design the Application for Menus and Action Bar.
9. Design the application to display the Drop-Down List Action Bar.

TEXTBOOKS:

1. "Android Programming", B.M Harwani, Pearson Education, 2013

Course Code	CLOUD COMPUTING LAB		L	T	P	C
21A050429	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	Database Management Systems, Python Programming and Data science	Semester	VI			

COURSE OBJECTIVES:

- To be familiar with developing web services/Applications.
- To learn to run SaaS Services
- To learn to run PaaS Services and virtual machines of different configuration

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design and Implement Web applications in Django Framework **(K4)**
CO2: Design and Run SaaS baes Application in Google Cloud **(K3)**
CO3: Program with PaaS Services on Microsoft Azure Cloud **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	-	2	2
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	3

LIST OF EXPERIMENTS:

I. Web Development using DJANGO Framework

a. Django Framework Packages Installation and Setting Environment to Run the Server
b. Python Program to develop Hello World Application in Django Framework
c. Python Program to develop Hello World Application in Django Framework with Templates
d. Python Program to develop Login Screen with Validation in Django Framework
e. Python Program to generate Prime Numbers up to a given number in Django Framework
f. Python Program to develop Login Screen with Validation in Django Framework using Data Bases

II. Programs on SaaS

a. Create a word document of your class time table and store locally and on the cloud with doc, and pdf format. (Use www.zoho.com and docs.google.com)
b. Create a spread sheet which contains employee salary information and calculate gross and total sal using the formula
DA=10% OF BASIC
HRA=30% OF BASIC

PF=10% OF BASIC IF BASIC<=3000
12% OF BASIC IF BASIC>3000
TAX=10% OF BASIC IF BASIC<=1500
=11% OF BASIC IF BASIC>1500 AND BASIC<=2500
=12% OF BASIC IF BASIC>2500
(Use www.zoho.com and docs.google.com)
NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX

c. Prepare a ppt on cloud computing –introduction, models, services and architecture. Ppt should contain explanations, images and at least 20 pages (Use www.zoho.com and docs.google.com)
d. Create your resume in a neat format using google and zoho cloud

III. Programs on PaaS

a. Develop Web Application to generate n even numbers and deploy it to Azure cloud
b. Develop Web Application to multiply two matrices deploy it to Azure cloud
c. Develop Web Application in php to validate login (username, password) and deploy to Azure cloud
d. Develop Web Application to display nth largest no from the given list of numbers and deploy it into Azure cloud
e. Develop Web Application in php to validate Login Screen using mysql data base and deploy it into Azure cloud

TEXTBOOKS:

1. "Cloud Computing A Hands-on Approach", Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

REFERENCE BOOKS:

1. "Azure in Action". Chris Hay, Brian Prince, Manning, 2010.
2. "Introducing Windows Azure", Henry Li, Apress, 1st Edition, 2009.
3. "Developing Applications for the Cloud on the Microsoft Windows Azure Platform", Matias Woloski, Microsoft Press, 1st Edition, 2010.
4. "Developing with Google App Engine", Eugene Ciurana, Apress, 1st Edition, 2009.
5. "Using Google App Engine", Charles Severance, O'Reilly Media; 1st Edition, 2009.

Course Code	PROGRAMMING IN C#		L	T	P	C
21A050705	(Common to CSE, CSE-AI, AIML)		1	0	2	2
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To apply Concept of C#.
- To illustrate the basic C# Concepts
- To demonstrate the use of C# in .Net framework.

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COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze a programming constructs of C# **(K3)**
CO2: Program with callback functions **(K3)**
CO3: Develop different types of applications in C# **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	2

LIST OF EXPERIMENTS:

Week I &2

Basic C# programs using the control structures and loops.

a) Hello world Program
b) Program to show the grade of a student. The marks of the student is taken as input
c) Factorial by recursion
d) Find the GCD

Week 3 & 4

Programs related to interfaces, Exceptions and Namespaces

a) Demonstrate use of Namespaces by simple program
b) Create an interface and write a class to implement it.
c) Demonstrate use of exception
d) Create a user defined Exception to show a message “under age” for those whose age is below i8 years.

Week 5 & 6

Programs on arrays, Enumerations and structs

Week 7 & 8

Programs on Delgates and Events

Week 9

Generics- stack, queue, delegates and events

Week 10 & 11

Implementing Design Pattens- Factory and singleton

TEXTBOOKS:

1. "Programming C# 8.0: Build Windows, Web and Desktop Applications", Ian Griffiths, O'Reilly Publications

ONLINE LEARNING RESOURCES:

1. https://www.w3schools.com/cs/index.php

Course Code	RESEARCH METHODOLOGY (Common to all branches)		L	T	P	C
21A000004			2	0	0	0
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know how to define a Research problem, select suitable design and experimental approach. **(K1)**
CO2: Formulate sampling design and various techniques implemented on data collection. **(K6)**
CO3: Correlate any two variables and find the solution using regression analysis. **(K4)**
CO4: Examine hypothesis testing procedure, Analyze the significance of variance and covariance. **(K4)**
CO5: Write a report on research work for seminars, conferences formats. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (6 Hrs)

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of research and its process. (L2)
- Explain various types of research. (L2)
- Explain the steps involved in research design. (L2)
- Understand the different research approaches. (L2)

UNIT – II (6 Hrs)

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement –

Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of sampling and sampling design. (L2)
- Explain various techniques in measurement and scaling. (L2)
- Understand various methods of data collection. (L2)
- Design survey questionnaires for different kinds of research. (L3)
- Analyze the questionnaires. (L4)

UNIT – III (6 Hrs)

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of correlation and regression. (L2)
- Compare and contrast correlation and regression. (L3)
- Explain various types of correlation. (L3)
- Apply the knowledge of C&R Analysis to get the results. (L3)

UNIT – IV (6 Hrs)

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Understand the hypothesis testing procedure. (L2)
- Compare and contrast Parametric and Non-parametric Tests. (L3)
- Understand the use of chi-square test in investigating the distribution of categorical variables. (L2)
- Analyze the significance of variance and covariance. (L4)

UNIT – V (6 Hrs)

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how to write a report and research paper. (L2)
- Explain various techniques of interpretation. (L2)
- Understand the importance of professional ethics in research. (L2)

- Design a scientific paper to present in the conferences/seminars. (L3)

TEXTBOOKS:

1. "Research Methodology: Methods and Techniques", C.R.Kothari, New Age International Publishers, 2nd Edition,.
2. "Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, Sage Publications

REFERENCE BOOKS:

1. "Research Methodology and Statistical Tools", P. Narayana Reddy and G. V. R. K. Acharyulu, Excel Books, New Delhi, 1st Edition.
2. "Business Research Methods", Donald R. Cooper & Pamela S Schindler, 9th Edition.
3. "Fundamentals of Statistics", S C Gupta, Himalaya Publications, 7th Edition

Course Code	DESIGN PATTERNS		L	T	P	C
21A050435	(Common to CSE, CSE-AI, AIML, CSE-IOT)		**3**	**0**	**0**	**3**
Pre-requisite	Object Oriented Programming through Java	Semester	VII			

COURSE OBJECTIVES:

- To understand design patterns and their underlying objects oriented concepts.
- To learn the day-to-day problems faced by object-oriented designers and how design patterns solve them
- To provide an interface for creating families of related objects without specifying their concrete classes.
- To know the consequences of combining patterns on the overall quality of a system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solving various Problems Using Design Patterns. **(K3)**
CO2: Applying various patterns to problems in designing lexi. **(K3)**
CO3: Comparing various structural patterns. **(K4)**
CO4: Applying Behavioral Patterns to various design issues. **(K3)**
CO5: Analysing and comparing various Patterns. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	2
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	3	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	3	-

UNIT – I (9 Hrs)

Introduction to Design Patterns: Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing the Catalog, Solving of Design Problems using Design Patterns, Selection of a Design Pattern, Use of Design Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Develop design patterns in Small Talk MVC (L6).
- How to select and use a Design Pattern (L1).
- Solve problems using design patterns (L3).

UNIT – II (9 Hrs)

Designing A Document Editor: Design problems, Document structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel standards, Supporting

Multiple Window Systems, User Operations, Spelling Checking and Hyphenation. Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Apply eight different patterns to Document editor's design. (L3).
- Specify the kinds of objects to create new objects using prototype(L4).

UNIT - III (9 Hrs)

Structural Patterns: Structural Patterns-1: Adapter, Bridge, Composite. Structural Patterns-2: Decorator, Facade, Flyweight, Proxy, Discuss of Structural Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Understand structural patterns (L2).
- Explain adapter, bridge and composite structural patterns (L2).
- Create decorator, facade, flyweight and proxy structural patterns (L6)

UNIT – IV (9 Hrs)

Behavioural Patterns: Behavioural Patterns-1: Chain of Responsibility, Command, Interpreter, Iterator. Behavioural Patterns-2: Mediator, Memento, Observer.

Learning Outcomes: At the end of this unit, students should be able to

- Define behavioural patterns (L1).
- Demonstrate object scope behavioural patterns (L2).
- Justify description for different types of behavioural patterns (L5).

UNIT – V (8 Hrs)

Behavioural Patterns and History: Behavioural Patterns-2(cont'd): State, Strategy, Template Method, Visitor, and Discussion of Behavioural Patterns. What to Expect from Design Patterns, a Brief History. The Pattern Community, An Invitation, A Parting Thought

Learning Outcomes: At the end of this unit, students should be able to

- Identify behavioural patterns (L6).
- Justify different types of behavioural patterns (L5).
- Determine community for patterns (L4).

TEXTBOOKS:

1. "Design Patterns", Erich Gamma, Pearson Education.

REFERENCE BOOKS:

1. "Patterns in JAVA", Vol-I , Mark Grand, Wiley DreamTech.
2. "Patterns in JAVA", Vol-II, Mark Grand, Wiley DreamTech.

3. "JAVA Enterprise Design Patterns", Vol-III, Mark Grand, Wiley DreamTech.
4. "Pattern Oriented Software Architecture", Buschmann & others, John Wiley & Sons.

ONLINE LEARNING RESOURCES:

1. https://refactoring.guru/design-patterns
2. https://www.geeksforgeeks.org/software-design-patterns/
3. https://en.wikipedia.org/wiki/Software_design_pattern

Course Code	BIG DATA ANALYTICS USING HADOOP		L	T	P	C
21A050431	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VII			

COURSE OBJECTIVES:

- To familiarize with the installation of Hadoop and how to analyze the Big Data
- To understand the design concepts of HDFS
- To provide good insight for developing a MapReduce applications
- To understand Hadoop environment.
- To explore the concepts of Pig, Hive, Spark and HBase

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic concepts and importance of Big Data **(K2)**
CO2: Develop applications by installing and working with VMWare and Hadoop environment **(K4)**
CO3: Design MapReduce application with various input and output formats **(K4)**
CO4: Demonstrate cluster and Hive environment **(K3)**
CO5: Implement Pig, Spark and HBase applications **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	2	-
CO2	2	3	2	2	1	-	-	-	-	-	-	-	2	-
CO3	2	3	3	2	2	-	-	-	-	-	-	-	1	2
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction to Big Data: What is Big Data? Why Big Data is Important? Meet Hadoop, Data, Data Storage and Analysis, Comparison with other systems, History of Apache Hadoop, Hadoop Ecosystem, VMWare Installation of Hadoop. Analyzing the Data with Hadoop, Scaling Out.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the characteristics of datasets. (L3)
- Compare trivial data and big data for various applications. (L4)
- Choose and implement various ways of selecting suitable model parameters. (L1)

UNIT – II (9 Hrs)

HDFS: The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop File systems, The Java Interface, Data flow.

MapReduce: Developing a MapReduce application, The Configuration API, setting up the Development Environment, Running Locally on Test Data, Running on a Cluster

Learning Outcomes: At the end of this unit, students should be able to

- Understand and apply scaling up Hadoop techniques and associated technologies (L2)
- Estimate suitable test data. (L5)
- Apply the MapReduce application on a cluster. (L3)

<u>UNIT – III</u> (9 Hrs)

How MapReduce Works: Anatomy of a MapReduce, Job Run, Failures, Shuffle and Sort, Task Execution.

MapReduce Types and Formats: MapReduce Types, Input formats, output formats.

Learning Outcomes: At the end of this unit, students should be able to

- Explore the Anatomy of MapReduce. (L5)
- Illustrate various input and output formats of MapReduce. (L2)
- List various MapReduce types. (L1)

<u>UNIT – IV</u> (9 Hrs)

Hadoop Environment: Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration, Security.

Pig: Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User Defined Functions, Data Processing Operators.

Learning Outcomes: At the end of this unit, Student should be able to

- Show the cluster setup and installation. (L2)
- Demonstrate the Configure the Hadoop. (L2)
- Compare Hadoop with various Databases. (L5)

<u>UNIT – V</u> (8 Hrs)

Hive: Installing Hive, Running Hive, Comparison with traditional Databases, HiveQL, Tables, Querying Data.

Spark: Installing Spark, Resilient Distributed Datasets, Shared Variables, Anatomy of a Spark Job Run.

HBase: HBasics, Installation, clients, Building an Online Query Application.

Learning Outcomes: At the end of this unit, students should be able to

- Explain various frameworks of Big Data. (L2)
- Compare Hive with traditional Databases. (L4)
- Learn how to build an online query application. (L1)

TEXTBOOKS:

1. "Hadoop: The Definitive Guide", Tom White, 4th Edition, O'reilly Media, 2015
2. "Big Data, Big Analytics: Emerging business intelligence and analytic trends for today's businesses", Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, Wiley Cio Series

REFERENCE BOOKS:

1. "Making Sense of Data", Glenn J. Myatt, John Wiley & Sons, 2007
2. "Big Data Glossary", Pete Warden, O'Reilly, 2011.
3. "Intelligent Data Analysis", Michael Berthold, David J.Hand, Spingers, 2007.
4. "Understanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data", Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, McGraw Hill Publishing, 2012.
5. "Mining of Massive Datasets", Anand Rajaraman and Jeffrey David UIIman, Cambridge University Press, 2012.

Course Code	AI & APPLICATIONS (Common to CSE-AI, AIML)		L	T	P	C
21A310409			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To impart knowledge about Applications of Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand and apply the principles of AI. **(K2)**
CO2: Solve basic AI based problems. **(K4)**
CO3: Define the concept of Artificial Intelligence. **(K3)**
CO4: Apply AI technique store a l-world problems to develop intelligent systems. **(K4)**
CO5: Select appropriately from arrange of techniques when implementing intelligent systems.**(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

AI for Driver less systems:

Look: The MEMEX Reloaded, Inside a Search Engine, Google and the Mind, Deeper and Darker.

The Robotic chauffeur: Getting to driverless, A Cure for the deadliest disease, Seven delaying Myths, The time line.

A Driverless World: Friction-free personal mobility, Parking, Commuting, Take the pod – meet people, Anatomy of a Driverless cars: High definition digital maps, Digital Cameras, Light detection and ranging (lidar), Radio Detection and Ranging (Radar), Ultrasonic sensors (sonars), Global positioning systems (GPS), The inner ear(IMU), Drive by wire.

Learning Outcomes: At the end of this unit, students should be able to

- Understand to control parking and operation (L3)
- Understand the driverless World (L3)

UNIT – II (9 Hrs)

AI for Marketing:

Solving the Marketing Problem: - One-to-One Marketing, One-to-Many Advertising, The Four Ps, What Keeps a Marketing Professional Awake? The Customer Journey, We Will Never Really Know, How Do I Connect? Let Me Count the Ways, Why Do I Connect? Branding, Marketing Mix Modelling, Econometrics, Customer Life time Value, One-to-One Marketing—The Meme, Seat-of-the-Pants Marketing, Marketing in a Nut shell, What Seems to Be the Problem?

Learning Outcomes: At the end of this unit, students should be able to

- Understand Marketing Adverising (L3)
- Understand Problem definition (L4)
- Implementation of Optimization(L2)

UNIT – III (9 Hrs)

AI for Marketing:

Using AI to Get Their Attention-Market Research: Whom Are We After?, Market place Segmentation, Raising Awareness, Social Media Engagement, In Real Life, The B2B World, Using AI to Persuade -The In-Store Experience, On the Phone, The Onsite Experience -Web Analytics, Merchandising, Closing the Deal, Back to the Beginning: Attribution. Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the tensors, SVD (L3)
- Understand the Meta algorithms (L4)
- Implementation of Onsite Experience (L2)

UNIT – IV (9 Hrs)

AI for Customers:

Using AI for Retention- Growing Customer Expectations, Retention and Churn, Many Unhappy Returns, Customer Sentiment, Customer Service, Predictive Customer Service.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Sentiment analysis, SVD (L3)
- Prediction of Customer service and action (L4)

UNIT – V (9 Hrs)

AI for Image processing:

The role of medical image computing and machine learning in health care, Deep Learning and Machine Learning in Imaging: Basic Principles, how to develop Artificial Intelligence Applications, A Standardized Approach for preparing Imaging data for Machine Learning tasks in Radiology, Artificial Intelligence in Medicine: Validation and Study Design, Enterprise Imaging.

Learning Outcomes: At the end of this unit, students should be able to

- AI role in medical image Processing (L3)
- Understand the Intelligence in Medicine (L4)
- Implementation of AI applications (L2)

TEXTBOOKS:

1. "The Intelligent Web", Gautam Shroff, OXFORD University Press, 2013.
2. "Driver less Intelligent cars and the Road Ahead", The MIT Press Cambridge, Massachusetts London, England, 2016.

REFERENCE BOOKS:

1. "Artificial intelligence for Marketing", Jim Sterne, John Wiley & sons, 2017.
2. "Artificial Intelligence in Medical Imaging", Erik R. Ranschaert, Sergey Morozov, Paul R. Algra, Springer Nature Switzerland AG, 2019.

ONLINE LEARNING RESOURCES:

1. https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/artificial-intelligence-applications
2. https://www.udemy.com/course/deep-reinforcement-learning-in-python/

Course Code	PREDICTIVE ANALYSIS (Common to CSE-AI, AIML)		L	T	P	C
21A310410			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the terminology, technology and its applications
- To introduce the concept of Analytics for Business
- To introduce the tools, technologies & programming languages which is used in day to day analytics cycle

COURSE OUTCOMES:

CO1: Express the impact of data analytics for business decisions and strategy **(K2)**
CO2: Analyze the data analysis/statistical analysis **(K4)**
CO3: Develop the standard data visualization and formal inference procedures **(K3)**
CO4: Evaluate Data Architecture and Analyze the Predictions of different data **(K5)**
CO5: Estimate various Data Sources and structure of Documentation **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	3	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction to Predictive Analytics & Linear Regression What and Why Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of data and variables, Data Modelling Techniques, Missing imputations etc., Need for Business Modelling, Regression – Concepts, Blue property-assumptions-Least Square Estimation, Variable Rationalization, and Model Building etc.

Learning outcomes: At the end of this unit, students should be able to

- Identify the Linear Regression and Analytics. (L3)
- Analyzing Data modeling Techniques with statistical analysis of data. (L3)
- Develop the ability to build and assess data-based models. (L5)

UNIT – II (9 Hrs)

Logistic Regression: Model Theory, Model fit Statistics, Model Conclusion, Analytics applications to various Business Domains etc.

Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building– Regression, Classification, over fitting Pruning and complexity, Multiple Decision Trees etc.

Learning outcomes: At the end of this unit, students should be able to

- Identify various statistical analyses models with professional statistical software. (L3)
- Compare Regressions and Segmentation. (L2)

<u>UNIT – III</u> (9 Hrs)

Objective Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Over fitting, Pruning and complexity, Multiple Decision Trees etc.

Develop Knowledge, Skill, and Competences: Introduction to Knowledge skills & competences, Training & Development, Learning & Development, Policies and Record keeping, etc.

Learning outcomes: At the end of this unit, students should be able to

- Analyze objective segmentation and Learning of supervised and unsupervised. (L3)
- Interpret the Knowledge and Training & development (L2)
- Demonstrate proficiency with statistical **analysis of data**. (L4)

<u>UNIT – IV</u> (9 Hrs)

Time Series Methods /Forecasting, Feature Extraction: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average, Energy etc and Analyze for prediction. Project

Learning outcomes: At the end of this unit, students should be able to

- Identify different Time Series methods.(L3)
- Learn Different STL Approaches (L2)
- Study various Project methods and Approaches (L4)

<u>UNIT – V</u> (8 Hrs)

Working with Documents: Standard Operating procedures for documentation and knowledge sharing, Defining purpose and scope documents, Understanding structure of documents – case studies, articles, white papers, technical reports, minutes of meeting etc.,

Style and format, Intellectual Property and Copyright, Document preparation tools–Visio, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base, Peer review and feedback.

Learning outcomes: At the end of this unit, students should be able to

- Learn different Documentation models and Operating Procedures. (L2)
- Understanding the structure of Documents (L4)
- Define different corporate knowledge base for Accessing and updating. (L1)

TEXTBOOKS:

1. "Student's Handbook for Associate Analytics – III".

REFERENCE BOOKS:

1. "An Introduction to Statistical Learning with Applications in R", Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani.

Course Code	BIO INFORMATICS (Common to CSE-AI, AIML)		L	T	P	C
21A310411			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To gain knowledge on various techniques, algorithms and tools employed in DNA sequencing, assembly and its applications in Next Generation Sequencing.
- To describe about various approaches in genome sequencing and NGS
- To Classify and explain about tools used for genome sequence assembly
- To Classify different types of Biological Databases.
- To Introduce to the basics of sequence alignment and analysis.
- To learn about biological macromolecular structures and structure prediction methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Gain knowledge about various Biological databases that provides information about nucleic acids and protein. **(K2)**
CO2: Describe about the different types of Biological databases. **(K4)**
CO3: Explain about different types of protein and other organism specific databases. **(K3)**
CO4: Overview about types and Biological data and database search tools. **(K4)**
CO5: Get exposed to computational methods, tools and algorithms employed for Biological Data Interpretation **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

INTRODUCTION TO BIOINFORMATICS: Scope of Bioinformatics, Elementary commands and protocols, ftp, telnet, http. Primer on information theory and search tools in bioinformatics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Concept of Bioinformatics (L3)
- Differentiation between elementary protocols & Search tools (L3)
- Understand the Bio-Applications (L4)
- Implement Model in Bioinformatics using protocols (L2)

UNIT – II (8 Hrs)

INTRODUCTION TO HOMOLOGY: Introduction to Homology (with special mention to Charles Darwin, Sir Richard Owen, Willie Henning, Alfred Russel Wallace).

Learning Outcomes*:* At the end of this unit, students should be able to

- Explain about Homology concepts (L3)
- Understand the Charles Darwin Techniques (L3)
- Differentiate between Charles Darwin and Sir Richard Owen (L3)

UNIT – III (9 Hrs)

SPECIAL TOPICS IN BIOINFORMATICS: DNA mapping and sequencing, Map alignment, Large scale sequencing methods Shotgun and Sanger method.

Learning Outcomes*:* At the end of this unit, students should be able to

- Various DNA Mapping Techniques (L2)
- Study of Sequencing (L3)
- Application Data on Large Scale sequencing (L5)

UNIT – IV (8 Hrs)

SEQUENCING ALIGNMENT AND DYNAMIC PROGRAMMING: Introduction to Biological databases, Organization and management of databases. Searching and retrieval of information from the World Wide Web. Structure databases- PDB (Protein Data Bank), Molecular Modeling Databases (MMDB). Primary Databases NCBL, EMBL, DDBJ. Introduction to Secondary Databases Organization and management of databases Swissprot, PIR, KEGG. Introduction to Bio-Chemical databases – organization and Management of databases. KEGG, EXPESY, BRENDA, WIT.

Learning Outcomes*:* At the end of this unit, students should be able to

- Programming in Biological Databases (L6)
- Design aspects of MMDB (L6)
- Use of different open source DB (L3)

UNIT – V (9 Hrs)

SEQUENCING ALIGNMENT AND DYNAMIC PROGRAMMING: Heuristic Alignment algorithms. Global sequence alignments- Neddle man & Wunsch Algorithm Smith-Waterman Algorithm-Local sequence alignments (Amino acid substitution Matrices (PAM, BLOSUM).

Learning Outcomes*:* At the end of this unit, students should be able to

- Basic Alignment Algorithms (L2)
- Understand the Global sequencing (L6)
- Apply the different Matrices (L6)

TEXTBOOKS:

1. " Bio informatics", David Mount, Cold Spring Harbor Publications, 2nd Edition, 2004.
2. "Introduction to Bioinformatics", T. K. Attwood, David Parry Smith, Pearson educations, 1st Edition, 2001.

REFERENCE BOOKS:

1. "Bioinformatics – A Practical Guide To The Analysis Of Genes And Proteins", Andreas D. Baxevanis, B. F. Francis Ouellette, Wiley Intr science Publishers, 3rd Edition , 2004.
2. "Bioinformatics – Principles And Applications", Harshawardhan P. Bal, TATA Mcgraw HILL, 6th Edition,2008.

Course Code	BUSINESS INTELLIGENCE		L	T	P	C
21A310412	(Common to CSE-AI, AIML)		**3**	**0**	**0**	**3**
Pre-requisite	Cloud Computing	Semester	VII			

COURSE OBJECTIVES:

- To learn Business Intelligence.

COURSE OUTCOMES

After completion of this course, the students will be able to

CO1: Understand the knowledge of Business Intelligence **(K2)**
CO2: Understand the elements of Business Intelligence **(K2)**
CO3: Build business projects **(K4)**
CO4: Generate and manage BI reports **(K4)**
CO5: Develop BI Deployment, Administration & Security. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	2	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Introduction to Business Intelligence: Understanding the scope of today's BI solutions and how they fit into existing infrastructure Assessing new options such as SaaS and cloud-based technology. Describe BI, its components & architecture, previewing the future of BI Crafting a better experience for all business users, End User Assumptions, Setting up Data for BI, The Functional Area of BI Tools, Query Tools and Reporting, OLAP and Advanced Analytics, Supporting the requirements of senior executives, including performance management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the BI solutions (L2)
- Design of cloud based technology for BI (L6)
- Use of BI tools (L3)

UNIT – II (9 Hrs)

Elements of Business Intelligence Solutions: Reports & ad hoc queries; Analyse OLAP data; Dashboards & Scorecards development, Metadata Models; Automated tasks & events; Mobile & disconnected BI; Collaboration capabilities; Real time monitoring capabilities; Software development kit; Consume BI through portals, web applications, Desktop applications.

Learning Outcomes: At the end of this unit, students should be able to

- Implement the Metadata Models (L6)
- Develop software development kit(L6)
- Implement web Applications (L3)

<u>UNIT – III</u> (9 Hrs)

Building the BI Project: Planning the BI project, Project Resources; Project Tasks, Risk Management and Mitigation, Cost-justifying BI solutions and measuring success, Collecting User Requirements, Requirements-Gathering Techniques; Prioritizing & Validating BI Requirements, Changing Requirements; BI Design and Development, Best Practices for BI Design; Post-Implementation Evaluations, Maintaining Your BI Environment.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Risk Management (L6)
- Define requirements (L2)
- Understand the concepts of Validations of BI (L3)

<u>UNIT – IV</u> (8 Hrs)

Reporting authoring: Building reports with relational vs Multidimensional data models ; Types of Reports – List, crosstabs, Statistics, Chart, map, financial etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting, Adding Summary Lines to Reports. Drill up, drill- down, drill-through capabilities. Run or schedule report, different output forms – PDF, excel, csv, xml etc.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Multidimensional data models (L2)
- Design Schedule Report (L4)

<u>UNIT – V</u> (9 Hrs)

BI Deployment, Administration & Security: Centralized Versus Decentralized Architecture, BI Architecture Alternatives, phased & incremental BI roadmap, System Sizing, Measurements and Dependencies, System Sizing, Measurements, and Dependencies. Setting Early Expectations and Measuring the Results. End-User Provisos. OLAP Implementations. Expanding BI Authentication Authorization, Access Permissions, Groups and Roles, Single-sign on Server Administration, Manage Status & Monitoring, Audit, Mail server & Portal integration, Back Up and Restore.

Learning Outcomes: At the end of this unit, students should be able to

- Understand BI Deployment models (L2)
- Implement Audit on backup and Restore (L4)

TEXT BOOKS:

1. Business Intelligence (IBM ICE Publication).

ONLINE LEARNING RESOURCES:

1. http://en.wikipedia.org/wiki/Business_intelligence.
2. http://www.webopedia.com/TERM/B/Business_Intelligence.html.
3. http://www.cio.com/article/40296/Business_Intelligence_Definition_and_Solutions.

Course Code	BLOCK CHAIN TECHNOLOGY		L	T	P	C
21A050436	(Common to CSE,CSE-AI, AIML)		3	0	0	3
Pre-requisite	Computer Networks	Semester	VII			

COURSE OBJECTIVES:

- To understand how block chain systems (mainly Bitcoin and Ethereum) work and to securely interact with them.
- To design, build, and deploy smart contracts and distributed applications
- To integrate ideas from block chain technology into their own projects

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding. **(K2)**

CO2: Identify the risks involved in building Block chain applications. **(K2)**

CO3: Review of legal implications using smart contracts. **(K2)**

CO4: Choose the present landscape of Block chain implementations and Understand Crypto currency markets. **(K3)**

CO5: Examine how to profit from trading crypto currencies **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		3	-	-	-	-	-	-	-	-	2
CO2	3	-	-	3	-	-	-	3	-	-	-	-	-	2
CO3	3	3	2	-	-	-	-	-	-	3	-	-	3	-
CO4	3	3	2		3	-	-	-	-	-	-	-	2	-
CO5	3	3	-	3	-	3	-	3	-	-	-	-	3	2

UNIT – I (10 Hrs)

Introduction: Introduction, Scenarios, Challenges Articulated, Block chain, Block chain Characteristics, Opportunities Using Block chain, History of Block chain. Evolution of Block chain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Block chain Evolution, Consortia, Forks, Public Block chain Environments, Type of Players in Block chain Ecosystem, Players in Market.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the benefits and challenges of Block chain (L2)
- Design the Blockchain applications (L6)

UNIT – II (9 Hrs)

Block chain Concepts: Block chain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on block chain, data storage on block chain, wallets, coding on block chain: smart contracts, peer-to-peer network, types of block chain nodes, risk associated with block chain solutions, life cycle of block chain transaction.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate Blockchain concepts (L2)
- Work with Blockchain technology (L6)

UNIT – III (9 Hrs)

Architecting Block chain solutions: Architecting Block chain solutions: Introduction, Obstacles for Use of Block chain, Block chain Relevance Evaluation Framework, Block chain Solutions Reference Architecture, Types of Block chain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Block chain Solutions, Architecture Considerations, Architecture with Block chain Platforms, Approach for Designing Block chain Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Make Blockchain solutions (L3)
- Distinguish types of Blockchain Applications (L4)

UNIT – IV (8 Hrs)

Ethereum Block chain Implementation: Ethereum Block chain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Etherscan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, Open Zeppelin Contracts

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the use of Ethereum development tools (L2)
- Create Ethereum accounts and work with them (L6)

UNIT – V (9 Hrs)

Hyper ledger Blockchain Implementation: Hyperledger Blockchain Implementation, Introduction, Use Case – Car Ownership Tracking, Hyperledger Fabric, Hyperledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chaincode Functions Using Client Application. Advanced Concepts in Blockchain: Introduction, Inter Planetary File System (IPFS), Zero Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the use of Hyperledger Blockchain Implementation (L2)
- Demonstrate Blockchain Cloud Offerings (L2)

TEXTBOOKS:

1. "Blockchain for Enterprise Application Developers", Ambadas, Arshad Sarfaraz Ariff, Sham Wiley
2. "Mastering Bitcoin: Programming the Open Blockchain", Andreas M. Antonpoulos, O'Reilly

REFERENCE BOOKS:

1. "Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions", Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. "Blockchain: Blueprint for a New Economy", Melanie Swan, O'Reilly

ONLINE LEARNING RESOURCES:

1. https://github.com/blockchainedindia/resources
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3. https://nptel.ac.in/courses/106105184
4. https://onlinecourses.nptel.ac.in/noc22_cs44/preview

Course Code	REAL TIME SYSTEMS (Common to CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A310413			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To develop an understanding of various Real Time systems Application
- To obtain a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
- To get in-depth hands-on experience in designing and developing a real operational system

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand concepts of Real-Time systems and modeling. **(K2)**
CO2: Recognize the characteristics of a real-time system. **(K4)**
CO3: Understand and develop document on an architectural design of a real-time system **(K3)**
CO4: Develop and document Task scheduling, resource management, real-time operating systems and fault tolerant applications of Real-Time Systems. **(K4)**
CO5: Understand features of RTOS and using different data bases related to RTOS **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the dead line, Timing constraint (L3)
- Differentiation between Hard vs Soft Real Time Systems (L3)
- Understand the temporal parameters (L4)
- Implement Periodic Task Model (L2)

UNIT – II (8 Hrs)

Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

Learning Outcomes*:* At the end of this unit, students should be able to

- Apply different types of Approaches for Real time Scheduling (L3)
- Understand the different algorithms for Real time Scheduling (L3)
- Differentiate between Offline Versus Online Scheduling (L3)

UNIT – III (9 Hrs)

Resources Sharing: Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand basic terminology of Resource Sharing (L2)
- Apply different protocols for accessing the resources (L3)
- Control the Concurrent Accesses to Data Objects (L5)

UNIT – IV (8 Hrs)

Real Time Communication: Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand the Soft and Hard RT Communication systems (L6)
- Design Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols. (L6)
- Use Internet and Resource Reservation Protocols (L3)

UNIT – V (9 Hrs)

Real Time Operating Systems and Databases: Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.

Learning Outcomes*:* At the end of this unit, students should be able to

- Use UNIX as RTOS(L2)
- Understand the Characteristic of Temporal data(L6)
- Apply the different data bases in Real Time Systems. (L6)

TEXTBOOKS:

1. "Real Time Systems", Jane W. S. Liu, Pearson Education Publication

REFERENCE BOOKS:

1. "Real Time Systems", Mall Rajib, Pearson Education
2. "Real-Time Systems: Scheduling, Analysis, and Verification", Albert M. K. Cheng, Wiley.

Course Code	EXPERT SYSTEMS (Common to CSE-AI, AIML)		L	T	P	C
21A310414			**3**	**0**	**0**	**3**
Pre-requisite	Probability & Statistics	Semester	VII			

COURSE OBJECTIVES:

- To understand the basic concepts of Expert systems.
- To gain knowledge in both theory and applications.
- To integrate theory with real-world situations.
- To appreciate the role played by expert systems in today's world.

COURSE OUTCOMES:

After the completion of this course, the student will be able to

CO1: Understand the features and characteristics of Expert systems. **(K2)**
CO2: Be acquainted with various tools and the development process of Expert systems. **(K3)**
CO3: Be familiar in building an Expert system. **(K3)**
CO4: Demonstrate awareness in the Expert system development. **(K4)**
CO5: Exhibit knowledge in the role of Expert system in various applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	2	1	2	1	1	-	-	-	-	-	-	-	1	-
CO4	2	-	2	-	2	-	-	-	-	-	-	-	-	2
CO5	3	-	-	-	2	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Introduction to Expert Systems: Features of Expert systems-ES Building. Real Experts - Keep human in loop. Organization of ES: Organizing Knowledge -Representing Knowledge - Expert systems vs conventional programs: Characteristics of ES-Activities of ES-Types of problems that ES solve.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the historical background of expert system (L3)
- Define an expert system (L3)
- Identify the human factors who develop and interact with expert system (L4)
- List the advantages and disadvantages of expert system (L2)
- State the features of expert system (L3)

UNIT – II (9 Hrs)

Expert System Tools: Knowledge Representation in Expert Systems: Using rules-using semantic nets-using frames. Nature of expert system tools: Programming languages-knowledge engineering Languages - system building aids-support facilities. ES building process. Stages in the development of ES Tools.

Learning Outcomes: At the end of this unit, students should be able to

- Grasping knowledge representation aspects and the basic components of expert systems and their applications (L3)
- Understand expert system in operation (L3)
- Explain the various steps of developing an expert system (L4)

UNIT – III (9 Hrs)

Building an Expert System: Expert system for a problem: ES development-possible, justified, appropriate. Building ES: Tasks-Stages. Choosing tools - Acquiring knowledge from Experts-knowledge acquisition process-interviewing the expert.

Learning Outcomes: At the end of this unit, students should be able to

- Understands the concept of knowledge engineering (L2)
- Explain the various steps of building an expert system (L4)
- Describe methods of knowledge acquisition and extraction (L3)
- Identify different development tools for expert systems (L3)

UNIT – IV (9 Hrs)

Difficulties with ES Development: Difficulties in developing an ES: Lack of resources-Limitations-Long time. Common Pitfalls in planning an ES: Choosing problem - Resources for building an ES-choosing the ES tool. Dealing with Domain Expert: Choosing domain expert-interacting with expert. ES Development Process: Implementation-Testing and Evaluation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the problems will the expert system be expected to solve (L6)
- Characterize the important aspect of the problem (L4)
- Identify Resources for building an Expert Systems(L3)
- Identify the goals or objectives of building the expert system (L3)
- Evolves a useful representation for the knowledge and uses it to develop a prototype expert system. (L4)

UNIT – V (9 Hrs)

Expert systems in Marketplace: ES at Universities-Research organizations - knowledge engineering companies. High performance Expert Systems used in Research – Business Computer Systems - Expert systems to Intelligent systems

***Learning Outcomes**:* At the end of this unit, students should be able to

- Analyse the development process of expert system through various case studies (L6)
- Assemble various parts of knowledge and skills in order to devise the approach to solution. (L6)

TEXTBOOKS:

1. "Introduction to Artificial Intelligence and Expert Systems", Patterson, Pearson Education India, 2015.
2. "Expert Systems in Engineering Applications", Spyros Tzafestas, Springer, 2011.

REFERENCE BOOKS:

1. "A Guide to Expert Systems", Donald. A.Waterman, Pearson Education, 3rd Edition, 2009.
2. "Expert Systems-Principles and Programming", J. Giarratano and G. Riley, PWS Publishing Company, 4th Edition, 2004.
3. "Introduction to Expert Systems", Peter Jackson, Addison Wesley Longman, 1999.
4. "Expert Systems", Nikolopoulos, Marcel Dekker Inc., 1997.

Course Code	MANAGEMENT SCIENCE (Common to all Branches)		L	T	P	C
21A110204			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concepts and principles of management in real life industry design and develop organization chart and structure for an enterprise. **(K3)**

CO2: Apply operations management techniques in real life industry. **(K3)**

CO3: Apply the concepts of HRM in Recruitment, Selection, Training & Development. **(K3)**

CO4: Develop PERT/CPM charts for projects of an enterprise and estimate time & cost of a project and to develop Mission, Objectives, Goals & Strategies for an enterprise in dynamic environment. **(K3)**

CO5: Understand & apply modern management techniques wherever possible. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	3	-	-	-

UNIT – I (9 Hrs)

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of management and organization (L2)
- Apply the concepts & principles of management in real life industry (L3)
- Analyze the organization chart & structure for an enterprise.(L4)
- Evaluate and interpret the theories and the modern organization theory (L5)

UNIT – II (10 Hrs)

Operations Management: Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming‘s contribution to Quality. **Material Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the core concepts of Management Science and Operations Management (L2)
- Apply the knowledge of Quality Control, Work-study principles in real life industry (L3)
- Evaluate Materials departments & Determine EOQ (L5)
- Analyze Marketing Mix Strategies for an enterprise (L4)
- Create and design advertising and sales promotion (L5)

UNIT – III (6 Hrs)

HUMAN RESOURCES MANAGEMENT: HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development (L2)
- Apply Managerial and Operative Functions (L3)
- Analyze the need of training (L4)
- Evaluate performance appraisal (L5)
- Design the basic structure of salaries and wages (L5)

<u>UNIT – IV</u> (12 Hrs)

Strategic & Project Management: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

Learning Outcomes: At the end of this unit, students should be able to

- Understand Mission, Objectives, Goals & Strategies for an enterprise (L2)
- Apply SWOT Analysis to strengthen the project (L3)
- Analyze Strategy formulation and implementation (L4)
- Evaluate PERT and CPM Techniques (L5)
- Create in competing the projects within given time (L5)

<u>UNIT – V</u> (8 Hrs)

Contemporary Issues in Management: The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand modern management techniques (L2)
- Apply Knowledge in modern management (L3)
- Analyze CRM, TQM (L4)
- Evaluate Six Sigma concept and SCM (L5)

<u>TEXTBOOKS:</u>

1. "Management Science", A.R Aryasri, TMH, 2013
2. "Management", Stoner, Freeman, Gilbert, Pearson Education, New Delhi, 2012.

<u>REFERENCE BOOKS:</u>

1. "Essentials of Management", Koontz &Weihrich, TMH, 6th Edition, 2005.
2. "Management Principles and Guidelines", Thomas N. Duening & John M. Ivancevich, Biztantra.
3. "Production and Operations Management", Kanishka Bedi, Oxford University Press, 2004.
4. "Modern Management", Samuel C. Certo, 9th Edition, PHI, 2005

Course Code	HACKING TOOLS		L	T	P	C
21A050706	(Common to CSE, CSE-AI, AIML, CSE-IOT)		1	0	2	2
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the effects of Hacking
- To protect themselves from hacking
- To identify various types of Hacking Tools

.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various Hacking Threats.**(K4)**

CO2: Perform various Hacking Methods.**(K3)**

CO3: Evaluate the various types of Hacking Techniques **(K4)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	2

LIST OF EXPERIMENTS:

Week 1

Network Security and Threats, Cyber Ethics Hacking Introduction

Week 2

Scanners :- What is scanning? How to perform Scanning on a demo-website.

Week 3

Viruses and worms and Trojans. Virus Analysis

Week 4

Snooping:- Email, DNS and IP

Week 5

Honey Pots: Creation and Execution

Week 6

Information Gathering , Session Hijacking

Week 7

Hacking Wireless Networks

Week 8 & 9

SQL injections and Hacking Mobiles

Week 10 & 11

Social Engineering and safety requirements

TEXTBOOKS:

1. "Hack-x-crypt: a straight forward guide towards ethical hacking and cyber-Security", Udval sahay

REFERENCE BOOKS:

1. "ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking", Hein Smith

ONLINE LEARNING RESOURCES:

1. https://www.synopsys.com/glossary/what-is-ethical-hacking.html#:~:text=Definition,and%20actions%20of%20malicious%20attackers.
2. https://intellipaat.com/blog/what-is-ethical-hacking/

OPEN ELECTIVE – I

<table>
<tr><td>Course Code</td><td rowspan="2" colspan="2">AIR POLLUTION AND CONTROL</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A010501</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">V</td></tr>
</table>

COURSE OBJECTIVES:

- To identify the sources of air pollution
- To know the composition and structure of atmosphere
- To know the pollutants dispersion models
- To understand the working of air pollution control equipment
- To identify the sources of noise pollution and their controlling methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the sources of air pollution. **(K2)**
CO2: Explain the composition and structure of atmosphere. **(K4)**
CO3: Discuss the general characteristics of stack emissions and their behavior. **(K2)**
CO4: Understand the mechanism of Control of air pollutants. **(K2)**
CO5: Know about the noise sources, mapping, prediction equations etc. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	-	-	-	3	1	-	-	-	-	3	1
CO2	3	1	3	-	-	-	3	1	-	-	-	-	1	1
CO3	3	2	2	-	-	-	3	1	-	-	-	-	2	2
CO4	3	1	2	-	-	-	3	1	-	-	-	-	1	1
CO5	3	2	2	-	-	-	3	1	-	-	-	-	1	2

UNIT – I (9 Hrs)

Introduction: sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance. Indoor Air Pollution– sources, effects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the character of atmospheric pollutants and their effect. (L4)

UNIT – II (9 Hrs)

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Wind rose diagram.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the composition and structure of atmosphere. (L4)

- Write the maximum mixing depth and windrose diagram. (L6)

UNIT – III (9 Hrs)

General characteristics of stack emissions, plume behavior, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources. Monitoring of particulate matter and gaseous pollutants –respirable, non-respirable and nano - particulate matter. CO, CO2, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

Learning Outcomes: At the end of this unit, students should be able to

- Express about the general characteristics of stack emissions and their behavior. (L6)
- Analyze the monitoring of particulate matter and gaseous pollutants. (L4)

UNIT – IV (9 Hrs)

Air Pollution Control equipment for particulate matter & gaseous pollutants– gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – Adsorption, Absorption, Scrubbers, Condensation and Combustion.

Learning Outcomes: At the end of this unit, student should be able to

- Explain the various air pollution control equipment. (L3)

UNIT – V (9 Hrs)

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the noise sources, mapping, prediction equations etc., (L5)

TEXTBOOKS:

1. “Air Pollution - Its Origin and Control”, Wark K., Warner C.F., and Davis W.T, Harper & Row Publishers, New York.
2. “Environmental Engineering”, H.S. Peavy, D.R. Row & G. Tchobanoglous, Mc Graw Hill International Edition

REFERENCE BOOKS:

1. “Air Pollution”, Perkins H.C., McGraw Hill.
2. “Air Pollution Control Theory”, Crawford M., TATA McGraw Hill.
3. “Air Pollution”, Stern A.C., Volume I, II, III.
4. “Air Pollution”, Seinfeld N.J., McGraw Hill.
5. “Air Quality Management”, Stern A.C., Volume V.
6. “Air Pollution”, M N Rao and HVN Rao, Tata McGraw Hill publication

ONLINE LEARNING RESOURCES:

1. http://www.epa.gov
2. http://www.indiaenvironmentportal.org.in
3. http://nptel.iitm.ac.in
4. http://www.filtersource.com

Course Code	ELECTRIC VEHICLES		L	T	P	C
21A020501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- Get exposed to EV system configuration and parameters
- Know about electro mobility and environmental issues of EVs
- Understand about basic EV propulsion and dynamics
- Understand about fuel cell technologies for EV and HEVs
- Know about basic battery charging and control strategies used in electric vehicles

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand and differentiate between conventional and latest trends in Electric vehicles. **(K2)**

CO2: Analyze various EV resources, EV dynamics and Battery charging. **(K4)**

CO3: Apply basic concepts of EV to design complete EV system. **(K3)**

CO4: Design EV system with various fundamental concepts. **(K5)**

CO5: Analyze the various control strategies used in battery charging in the electric vehicles. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to EV Systems and Parameters: Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic concepts of EV to design complete EV system. (L3)
- Explain EV system configuration. (L3)
- Understand various EV parameters. (L2)

UNIT – II (9 Hrs)

EV and Energy Sources: Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand electro mobility and environmental issues of EVs. (L2)
- Explain the history of Electric power trains. (L3)
- Compare conventional, battery, hybrid and fuel cell electric systems. (L3)

UNIT – III (9 Hrs)

EV Propulsion and Dynamics: Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi-motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of EV system. (L2)
- Choose a suitable electric propulsion system. (L2)
- Classify EV motors and their applications. (L3)

UNIT – IV (9 Hrs)

Fuel Cells: Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples.

Learning Outcomes: At the end of this unit, students should be able to

- FUEL CELLS: Explain the working principle of Fuel cells. (L3)
- Analyze fuel cell technologies for EV and HEVs. (L4)
- Compare series, series-parallel hybrid systems. (L3)

UNIT – V (9 Hrs)

Battery Charging and Control: Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modeling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic battery charging in Electric Vehicles. (L2)
- Analyze control strategies used in electric vehicles. (L4)

TEXTBOOKS:

1. "Modern Electric Vehicle Technology", C.C Chan, K.T Chau, Oxford University Press Inc., New York 2001.
2. "Electric Vehicle Technology Explained", James Larmenier, John Lowry, Wiley, 2003.

REFERENCE BOOKS:

1. "Electric and Hybrid Vehicles Design Fundamentals", Iqbal Husain, CRC Press 2005.
2. "Advanced Electric Drive Vehicles", Ali Emadi, CRC Press, 2015.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

Course Code	ELECTRICAL DISTRIBUTION SYSTEMS		L	T	P	C
21A020502			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- The classification of distribution systems
- The aspects and design considerations in DC and AC distribution and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the various factors associated with power distribution. **(K3)**
CO2: Make voltage drop calculations in given distribution networks. **(K3)**
CO3: Learn principles of substation maintenance. **(K2)**
CO4: Compute power factor improvement for a given system and load. **(K3)**
CO5: Understand implementation of SCADA for distribution automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Load Modeling and Characteristics: Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural, and Industrial) and Their Characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of the electrical distribution systems. (L2)
- Analyze the relationship between load factor and loss factor. (L4)
- Understand the various loads and its characteristics. (L2)

UNIT – II (9 Hrs)

Classification Of Distribution Systems: Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the classification of electrical distribution systems. (L2)
- Analyze the design considerations of the radial and loop type feeders. (L4)

UNIT – III (9 Hrs)

Substations: Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar Sectionalized Single Bus Bar, With Relevant Diagrams.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the layout of the substation and various equipment installed. (L2)
- Analyze the classification of the substation based on insulating medium. (L4)
- Understand various bus bar schemes in substation. (L2)

UNIT – IV (9 Hrs)

Power Factor Improvement: Three Phase Balanced Primary Lines. Causes of Low P.F - Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

UNIT – V (9 Hrs)

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

TEXTBOOKS:

1. "Electric Power Distribution Engineering", Turan Gonen, CRC Press, 3rd Edition, 2014.
2. "Electric Power Distribution", A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

REFERENCE BOOKS:

1. "Electric Power Distribution Automation", Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010
2. "Electrical Power Distribution Systems", V. Kamaraju, Jain Book Depot, 2012.

<table>
<tr><td>Course Code</td><td rowspan="2" colspan="2">ROBOTICS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A030501</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">V</td></tr>
</table>

COURSE OBJECTIVES:

- To familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control
- To choose and incorporate robotic technology in engineering systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the introduction and types of robots. **(K2)**

CO2: Analyze kinematics using forward and inverse kinematics and dynamics of robots using transformation, Jacobians, Lagrange – Euler and Newton – Euler formation. **(K4)**

CO3: Understand the working principle of different types of actuators and sensors. **(K2)**

CO4: Understand the motion types and robot programming software. **(K2)**

CO5: Know importance of robotic Applications in manufacturing. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	1	-	-	-	-	-	-	2	3	-
CO2	1	-	3	-	-	-	-	-	-	-	-	1	1	3
CO3	3	-	2	-	2	-	-	-	-	-	-	1	3	1
CO4	3	-	2	-	3	-	-	-	-	2	-	-	3	2
CO5	3	-	2	-	2	-	-	-	-	1	-	2	3	-

UNIT – I (8 Hrs)

Introduction to Industrial Robots: Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of robots. (L2)
- Differentiate types of robots and robot grippers. (L4)

UNIT – II (8 Hrs)

Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation-D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformation, Jacobians .Lagrange – Euler and Newton – Euler formations.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire the knowledge about robot kinematics and dynamics. (L2)
- Analyze the forward and inverse kinematics of robot manipulators. (L4)

UNIT – III (9 Hrs)

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile sensors, Proximity sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the various types of robot actuators and feedback components. (L1)
- Understand the working of robot sensors. (L2)

UNIT – IV (11 Hrs)

Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion.

Robot programming - Types – features of languages and software packages.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze motion in links and joints of a robot. (L4)
- Understand the types and software packages of robots. (L2)

UNIT – V (9 Hrs)

Robot Application in Manufacturing: Material Transfer -Material handling, loading and unloading - Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Learning Outcomes: At the end of this unit, students should be able to

- Express the various applications of robots in industries. (L2)
- Acquire the knowledge about real time applications of robots in manufacturing. (L2)

TEXTBOOKS:

1. "Industrial Robotics", M.P. Groover, TMH.
2. "Robotics, Fundamental Concepts and analysis", Ashitave Ghosal, Oxford Press
3. "Robotics and Control", Mittal R K & Nagrath I J, TMH.

REFERENCE BOOKS:

1. "Robotics", Fu K S, McGraw Hill.
2. "An Introduction to Robot Technology", P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. "Robotic Engineering", Richard D. Klafter, Prentice Hall

4. “Introduction to Robotics”, John J. Craig, Pearson Edu
5. “Automation, Production systems and CIM”, M.P. Groover, Pearson Edu

Course Code	BASICS OF MECHANICAL ENGINEERING		L	T	P	C
21A030502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize students with basic power plants types, turbines, pumps, IC engines, boilers, refrigeration and air conditioning process and their performance aspects.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know types of power generating plants by using conventional or Non-conventional resources. **(K2)**

CO2: Understand and implementation of turbines, explain different types of pumps and their application. **(K2)**

CO3: Describe To familiarize the developments in IC engines. **(K2)**

CO4: Uunderstand the concept of the boilers. **(K2)**

CO5: Explain the working principles of refrigeration and air conditioning systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	2	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-	-	2	-	-

UNIT – I (10 Hrs)

Power Plant Engineering: Introduction – Energy Renewable and Non – Renewable Energy, Sources – Classification of Power Plants based on Sources of Energy – Thermal Power Plant or Steam Power Plant – Hydro Electric Power – Nuclear Fission, Chain Reaction, Layout of Nuclear Power Plant – Diesel Power Plant – Gas Turbine Power Plant – Open Cycle Gas Turbine, Closed Cycle Gas Turbine Power Plant, Comparison of Diesel Power Plant with Gas Turbine Power Plant.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the energy Renewable and Non – Renewable Energy Sources. (L2)
- Illustrate the working principle of Steam, Nuclear & open cycle, and closed cycle gas turbine. (L2)

<u>UNIT – II</u> (10 Hrs)

Hydraulic Turbine – Classification of Hydraulic Turbines, Impulse Turbine, Reaction Turbine, Difference between Impulse and Reaction Turbine.

Pumps – Classification of Pumps, Centrifugal Pump, Applications of Centrifugal Pump, Priming, Reciprocating Pumps, Single Acting Reciprocating Pump, Working of a Double acting Reciprocating Pump, Comparison of Reciprocating Pump with Centrifugal Pump.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Hydraulic Turbines, Impulse Turbine, and Reaction Turbine. (L2)
- Understand the working of Centrifugal Pump, Reciprocating Pumps and Comparison between them. (L2)

<u>UNIT – III</u> (10 Hrs)

I.C Engine: Heat Engine – Types of Heat Engine – External Combustion Engine, IC Engine (Internal Combustion), Classification of I.C. Engine, Two Stroke Petrol Engine, Four Stroke Engine, Valve Timing Diagram, Port Timing Diagram, Comparison of Two Stroke and Four Stroke Engines, Comparison of Petrol Engine and Diesel Engine, Fuel System of a Petrol Engine, Ignition Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of External Combustion Engine, IC Engine. (L2)
- Illustrate the working of Two Stroke Petrol Engine, Four Stroke Engine. (L2)

<u>UNIT – IV</u> (7 Hrs)

Boilers: Classification of Boilers – Simple Vertical Boiler – Cochran Boiler – Babcock and Wilcox Boiler – Benson Boiler – Difference between Fire Tube and Water Tube Boilers – Boiler Mountings – Boiler Accessories – Difference between Boiler Mountings and Accessories.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of different types Fire Tube and Water Tube Boilers.(L2)

<u>UNIT – V</u> (8 Hrs)

Refrigeration and Air Conditioning: Introduction – Terminology of Refrigeration and Air Conditioning – Properties of Refrigerants – List of Commonly used Refrigerants – Types of Refrigerating System – Vapour Compression Refrigeration System – Vapour Absorption Refrigerator – Domestic Refrigerator – Air Conditioning – Application of Air Conditioning –Psychrometry – Window Air Conditioning.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Vapour Compression Refrigeration System – Vapour Absorption Refrigeration system. (L2)
- Illustrate the working of Air Conditioning. (L2)

TEXTBOOKS:

1. "Basic Civil and Mechanical Engineering", Er. R. Vaishnavi, Prof. V. Vijayan, Prof. M. Prabhakaran, S. Chand Publication, 2^{nd} Edition
2. "Elements of Mechanical Engineering", S Trymbaka Murthy, University Press, 4^{th} Edition

REFERENCE BOOKS:

1. "Elements of Mechanical Engineering", S. N. Lal, Cengage Learning, 2013
2. "Elements of Mechanical Engineering", S. Trymbaka Murthy, Universities Press, 2015
3. "Mechanical Technology", Dr M. Maruthi Rao and V. Pavan Kumar, Lambert Academic Publishing, 2022

Course Code	INTEGRATED CIRCUITS AND APPLICATIONS		L	T	P	C
21A040501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To introduce the basic building blocks of linear integrated circuits.
- To impart knowledge on linear and non-linear applications of Op-Amps.
- To design various circuits using Op-Amps.
- To familiarize with specialized ICs such as 555 timer and voltage regulators.
- To familiarize with digital ICs.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the construction and characteristics of Operational Amplifier IC **(K2)**

CO2: Explain various linear & non-linear applications of Op-amp **(K2)**

CO3: Develop knowledge on filters and describe internal circuit operation of 555 timer and voltage regulators ICs **(K3)**

CO4: Summarize combinational circuits using Digital integrated circuits **(K3)**

CO5: Explain the internal structure of sequential Digital integrated circuits **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	3	1	-
CO2	2	2	2	1	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	1	-	-	-	-	-	-	-	3	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	1	-

UNIT – I (8 Hrs)

INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER: Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of IC & classifications (L2)
- Understand the concepts of Operational amplifier. (L2)
- Illustrate the internal circuit of operational amplifier (L2)
- Analyze DC & AC characteristics of op-amp (L4)

UNIT – II (10 Hrs)

LINEAR APPLICATIONS OF OP-AMP: Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveformgenerators, Oscillators

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of integrator & differentiator circuits (L2)
- Understand the concepts of multivibrators and waveform generators (L2)
- Develop the output voltage expression for instrumentation amplifier (L3)
- Analyze the adder, subtractors, multiplier and divider circuits (L4)

UNIT – III (10 Hrs)

ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

TIMERS AND REGULATORS: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, Introduction- Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on 1st and 2nd order active filters. (L3)
- Understand the functionality of 555 timer. (L2)
- Understand the internal structure and functionality of voltage regulators (L2)

UNIT – IV (8 Hrs)

COMBINATIONAL CIRCUITS USING TTL 74XX ICS: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7-segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on the working of various combinational circuit ICs. (L3)
- Develop higher order combinational circuits from lower order Combinational ICs. (L3)

UNIT – V (9 Hrs)

SEQUENTIAL CIRCUITS USING TTL 74XX ICS: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493), Memory -SRAM & DRAM.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of sequential circuits using TTL ICs. (L2)
- Develop higher order Sequential circuits from lower order Sequential ICs. (L3)

TEXTBOOKS:

1. "Linear Integrated Circuit", D. Roy Choudhury, Shail B. Jain, New Age International Pvt.Ltd., New Delhi, India, 4th Edition, 2012
2. "OP-AMP and Linear Integrated Circuits", Ramakant A. Gayakwad, Prentice Hall / Pearson Education, New Delhi, 4th Edition, 2012
3. "Digital Fundamentals", Floyd, Jain, Pearson Education, New Delhi, 8th Edition, 2009.

REFERENCE BOOKS:

1. "Design with operational amplifiers and analog integrated circuits", Sergio Franco McGrawHill, New Delhi, 1997
2. "Digital Design Principles and Practices", John F Wakerly, Pearson Education, 4th Edition

Course Code	INTRODUCTION TO SIGNAL PROCESSING		L	T	P	C
21A040502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- To represent continuous time signals (both periodic and non-periodic) in the time domain, s-domain and the frequency domain.
- To understand the properties of analog filters, and have the ability to design Butterworth filters.
- To understand and apply sampling theorem and convert a signal from continuous time to discrete time and able to represent the discrete time signal in the frequency domain.
- To understand FIR and IIR filters to meet given specifications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain continuous time and discrete time signals and systems, in time and frequency domain. **(K3)**

CO2: Apply Fourier series and Fourier Transform to analyze periodic & non-periodic signals and their spectra. **(K3)**

CO3: Design and implement the analog filter using components/suitable simulation tools. **(K4)**

CO4: Apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time. **(K3)**

CO5: Design and implement the digital filter using suitable simulation tools. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction to Signals & Systems: Signal Definition, Signal Classification, System definition, System classification for both continuous time and discrete time, Basic Operations on Signals, Elementary Signals & Sequences, Definition of LTI systems, Transfer function of a LTI system, Concepts of Convolution and Correlation of signals, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different basic types of signals and systems. (L2)

- Understand various basic operations on signals and elementary signals. (L2)
- Describe continuous time signal and discrete time signal. (L2)
- Sketch the various types of basic signals for both continuous time & discrete time. (L3)
- Understand the LTI systems, convolution & correlation of signals. (L2)

UNIT – II (10 Hrs)

Fourier Series & Transform: Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems, Fourier Transform of arbitrary signal, Properties of Fourier Transform, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the periodic signals by applying Fourier series. (L4)
- Apply Fourier transform to solve problems. (L3)
- Analyze the spectral characteristics of signals. (L4)

UNIT – III (8 Hrs)

Analog Filters: Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of analog filters. (L2)
- Design and implement the analog Butterworth filters. (L4)

UNIT – IV (8Hrs)

Sampling Theorem & DFT: Sampling Theorem- Statement and proof, converting the analog signal to a digital signal, Practical sampling, The Discrete Fourier Transform, Properties of DFT, IDFT, Comparing the frequency response of analog and digital systems, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of sampling techniques. (L2)
- Illustrate signal sampling and its reconstruction. (L3)
- Explain the importance of discrete Fourier transform. (L3)

UNIT – V (10Hrs)

Digital Filters: Characteristics of FIR and IIR filters. Frequency response of ideal digital filters, Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, Comparison of FIR & IIR, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of IIR and FIR digital Filters. (L2)

- Analyze windowing techniques in FIR filters. (L4)
- Illustrate the digital filters of different techniques. (L3)
- Design IIR and FIR filters. (L4)

TEXTBOOKS:

1. "Signals, Systems and Communications", B. P. Lathi, BS Publications, 2008.
2. "Digital signal processing, principles, Algorithms and applications", John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 4th Edition, 2007.
3. "Discrete Time Signal Processing", A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

REFERENCE BOOKS:

1. "Linear Systems and Signals", B. P. Lathi, Oxford University press, 2nd Edition.
2. "Digital Signal Processing – Fundamentals and Applications", Li Tan, Elsevier, 2008.
3. "Signals, Systems and Transforms", C. L. Philips, J. M. Parr and Eve A. Riskin, PE, 3rd Edition, 2004.
4. "Signals and Systems", A.V. Oppenheim, A.S. Willsky and S. H. Nawab, PHI, 2nd Edition, 2013.
5. "Signals and Systems", A. Anand Kumar, PHI Publications, 3rd Edition, 2013.

OPEN ELECTIVE – II

Course Code	ENVIRONMENTAL POLLUTION AND CONTROL		L	T	P	C
21A010502			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart knowledge on aspects of air pollution & control and noise pollution.
- To impart concepts of treatment of waste water from industrial source.
- To differentiate the solid and hazardous waste based on characterization.
- To introduce sanitation methods essential for protection of community health.
- To provide basic knowledge on sustainable development.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the fundamentals of solid waste management, practices adopted in his town / village and its importance in keeping the health of the city. **(K2)**

CO2: Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards**. (K2)**

CO3: Differentiate the treatment techniques used for sewage and industrial wastewater Treatment. **(K3)**

CO4: Integrate the methods of environmental sanitation and the management of community facilities without spread of epidemics. **(K6)**

CO5: Appraise the importance of sustainable development while planning a project or executing an activity. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

AIR POLLUTION:

Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

Learning Outcomes: At the end of this unit, students should be able to

- Understand control mechanism of air pollutants. (L2)
- Design noise reduction techniques. (L6)

UNIT – II (9 Hrs)

INDUSTRIAL WASTE WATER MANAGEMENT:

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of treatment process of industrial effluents. (L2)
- Design treatment plants. (L6)

UNIT – III (9 Hrs)

SOLID WASTE MANAGEMENT: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

HAZARDOUS WASTE: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Learning Outcomes: At the end of this unit, students should be able to

- Categorize of solid waste and separation and procession solid waste. (L4)
- Estimate Hazardous wastes. (L5)
- Develop execute solid waste and hazardous waste management. (L6)

UNIT – IV (9 Hrs)

ENVIRONMENTAL SANITATION: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of hygienic environment. (L2)
- Choose appropriate rural sanitation methods to keep surrounding clean. (L5)

UNIT – V (9 Hrs)

SUSTAINABLE DEVELOPMENT: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability– Industrialization and sustainable development – Cleaner production in achieving sustainability-sustainable
development.

Learning Outcomes: At the end of this unit, students should be able to

- Express sustainable development strategies. (L6)

TEXTBOOKS:

1. "Environmental Engineering", Peavy, H. S., Rowe, D.R, Tchobanoglous, Mc-Graw Hill International Editions, New York 1985.
2. "Environmental Science and Engineering", J. G. Henry and G. W. Heinke, Pearson Education.

REFERENCE BOOKS:

1. "Waste water treatment- concepts and design approach", G. L. Karia and R.A. Christian, Prentice Hall of India
2. "Air pollution", M. N. Rao and H. V. N. Rao, Tata Mc.Graw Hill Company.
3. "Weiner and Robin Matthews Environmental Engineering", Ruth F., Elesevier, 4th Edition, 2003.
4. "Air Pollution and Control", K. V. S. G. Murali Krishna, Kousal & Co. Publications, New Delhi.

Course Code	SMART GRID		L	T	P	C
21A020503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Impart knowledge on relevance smart grids technologies, its potential challenges and applications to the real world.
- Provide deeper insight on the customer's needs and consumption pattern for better load management and forecasting.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operational and functional aspects of smart grid, architecture and technical challenges. **(K2)**

CO2: Analyze the communication signals from various measuring units and sub-networks for monitoring secured operation adhering relevant standards. **(K4)**

CO3: Assess the various energy options and apply them for the sustainability of Smart grid. **(K2)**

CO4: Develop strategies for demand side management using various communication protocols. **(K3)**

CO5: Understand the challenges and relevant standards in interoperability and cyber security of Smart grid. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to Smart Grid: Introduction to smart grid as per National Institute Standards and Technology (NIST), smart grid architecture, functions of smart grid components, smart grid initiatives in India, technology drivers and challenges. Overview of the technologies required for smart grid and architecture of smart substation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concept of smart grid Technology. (L2)
- Explain Smart grid functions. (L3)
- Understand Smart grid architecture. (L2)

UNIT – II (9 Hrs)

Smart Grid Measurement Technology: Introduction, standards for information exchange, monitoring, smart meters, and measurement technologies, WAMS, PMUs, GIS and google mapping tools and multi-agent systems technology.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the measurement technologies. (L2)
- Explain the google mapping tools. (L3)
- Compare WAMS and PMU. (L3)

UNIT – III (9 Hrs)

Sustainable Energy Options for the Smart Grid: Renewable Energy Resources, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, Storage Technologies.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of Renewable energy source. (L3)
- Understand basic concept of Electric Vehicles. (L2)

UNIT – IV (9 Hrs)

Demand Side Management and Communication Technology: Introduction, Demand Side Management objectives and its classification. Communication technologies: IEEE 802X series. Layouts of Sub-networks: LAN, WAN, NAN, HAN and FAN and its comparison.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic concepts of management objectives. (L3)
- Compares the WAN, LAN, NAN, HAN. (L3)

UNIT – V (9 Hrs)

Interoperability, Standards and Cyber Security : Introduction, State-of-the-Art-Interoperability, Benefits and Challenges of Interoperability, Model for Interoperability in the Smart Grid Environment, Smart Grid Network Interoperability, Interoperability and Control of the Power Grid, Standards, Approach to Smart Grid Interoperability Standards, Smart Grid Cyber Security, Cyber Security State of the Art, Cyber Security Risks, cyber security concerns associated with Advanced Metering Infrastructure, Mitigation approach to cyber security risks.

Learning Outcomes: After successful completion of this unit, the students will be able to

- Understand basic Benefits and Challenges of Interoperability. (L2)
- Analyze Smart Grid Network Interoperability. (L4)

TEXTBOOKS:

1. “Smart Grid: Fundamentals of design and analysis”, James Momoh, John Wiley & sons

Inc, IEEE press, 2012

2. "Smart Grid: Technology and Applications", Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons Inc., 2012.

REFERENCE BOOKS:

1. "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Fereidoon P. Shoshonis, Academic Press, 2012
2. "The smart grid: Enabling energy efficiency and demand response", Clark Grellings, Fairmont Press Inc, 2009.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/107/108107113/
2. https://smartgrid.ieee.org/resources/webinars

Course Code	ENERGY STORAGE SYSTEMS		L	T	P	C
21A020504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need for energy storage
- Understand about the fundamentals of ESS
- Know about types, features and benefits of ESS
- Know about various management and control including market potential of ESS
- Study about various applications of ESS

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: To get exposed to latest technology of ESS. **(K3)**

CO2: Understand the principle, features, and benefits of ESS. **(K2)**

CO3: Understand the marketing and management strategies of ESS in working environment. **(K2)**

CO4: Distinguish wide variety of applications of EES for practical applications. **(K2)**

CO5: Know about latest technology applications of Battery SCADA, which is going to be vital in future applications, trend in new and renewable energy source. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Fundamentals of ESS: Definitions, Characteristics of ESS, Electricity, and roles of ESSs, Emerging needs in ESS, Classification of ESSs, Roles of Electrical storage technologies.

Learning Outcomes: At the end of this unit, students should be able to

- To know about the fundamentals of ESS. (L4)
- To know about emerging needs and roles of ESS. (L4)
- To know about various classifications of ESS. (L4)
- To understand about roles of energy storage technologies. (L2)

UNIT – II (9 Hrs)

Types and Features of ESS Technologies: Mechanical storage systems, Electromechanical storage systems, Chemical energy storage, Electrical storage systems, Thermal storage systems, standards for EES, Comparison of ESS technology storage systems, Power and discharge duration, Energy and power density, Storage operating cost, Power quality, Reactive power capability.

Learning Outcomes: At the end of this unit, students should be able to

- To understand about various types of ESS technologies. (L2)
- To understand about standards for ESS. (L2)
- To learn about power and discharge duration of ESS. (L2)
- To know about preliminaries of ESS operating cost. (L4)
- To understand about power quality issues and reactive power capability of ESS. (L2)

UNIT – III (9 Hrs)

Storage Benefits: Definitions, Applications, specifications, benefits, Electric energy time shift, Electric supply capacity, reserve capacity, voltage support, Electric service power quality and reliability, Incidental benefits, energy losses, access charges, Risk, dynamic operating benefits, p.f. correction, reduced air emissions, flexibility, energy benefits.

Learning Outcomes: At the end of this unit, students should be able to

- To know various storage benefits. (L4)
- To distinguish between application specific benefits and identical benefits. (L2)
- To understand about electric service power quality and reliability issues. (L2)
- To learn about energy benefits from storage systems. (L3)

UNIT – IV (9 Hrs)

EES Market and Management: Utility and Consumer use, Measurement and Control hierarchy, Internal configurations, External connections, Battery SCADA, Market potential, estimation, role of aggregators, Maximum market potential estimates, Demand change management, Time-of-use energy cost management, storage modularity.

Learning Outcomes: At the end of this unit, students should be able to

- To understand about management of ESS technologies. (L2)
- To distinguish between internal and external configuration of ESS. (L2)
- To know about battery SCADA system and storage modularity. (L4)
- To distinguish between demand change and time-of-use energy cost management. (L2)

UNIT – V (9 Hrs)

Applications of EES: Power Vs Energy, Capacity Vs energy applications, specific power and discharge durations, Electric supply applications, ancillary service applications, End user/utility customer applications, Distributed energy storage applications, Locational, Non-locational and incidental applications.

Learning Outcomes: At the end of this unit, students should be able to

- To know about various ESS. (L4)
- To distinguish between power, capacity, energy applications of ESS. (L2)
- To distinguish between electric supply and ancillary applications. (L2)
- To understand about the importance of distributed energy storage applications. (L2)

TEXTBOOKS:

1. “Energy Storage Benefits and Market Analysis”, James M. Eyer, Joseph J. Iannucci and Garth P. Corey, Sandia National Laboratories, 2004
2. “The Electrical Energy Storage”, IEC Market Strategy Board, White paper.

REFERENCE BOOKS:

1. “Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide”, Jim Eyer, Garth Corey, Sandia National Laboratories”, Feb 2010.

Course Code	AUTOMATION IN INDUSTRIES		L	T	P	C
21A030503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need of automation
- Classify various types of automated transmission lines and components of automation.
- List and understand various material handling systems.
- Design various types of automated assembly systems
- Explain various automatic inspection systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand principles and basic elements of automation. **(K2)**
CO2: Understand the Detroit automation and automated flow lines. **(K2)**
CO3: Learn the material handling technology and assembly systems. **(K1)**
CO4: Learn the control systems technology and its process in automation. **(K1)**
CO5: Understand the inspection, testing and PLC's in automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	3	1	2	1	-	-	-	-	-
CO2	3	-	-	-	2	2	1	-	2	-	-	-	-	-
CO3	3	-	-	-	1	1	1	-	1	-	-	-	-	-
CO4	2	2	3	-	3	2	2	-	2	-	-	-	-	-
CO5	2	-	-	-	2	1	2	-	1	-	-	-	-	-

UNIT – I (9 Hrs)

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break-Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in process.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the principles of production, investment, cost concepts in automation. (L2)

UNIT – II (10 Hrs)

Detroit-Type Automation: Automated Flow lines, Methods of Work-part Transport, Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations.

Analysis of Automated Flow Lines: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the types of automation method concepts and machining operations. (L2)

UNIT – III (11 Hrs)

Material handling and Identification Technologies: The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc.

Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multistation Assembly Machines, Analysis of a Single Station Assembly Machine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Apply the techniques of material handling and automated assembly systems. (L4)

UNIT – IV (7 Hrs)

Control Technologies in Automation: Industrial Control Systems, Process Industries Verses Discrete- Manufacturing Industries, Continuous Verses Discrete Control, Computer Process Control and its Forms. Computer Based Industrial Control: Introduction & Automatic Process Control, Building Blocks of Automation System: LAN, Analog & Digital I/O Modules, SCADA System & RTU.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the industrial control technologies in automation. (L2)

UNIT – V (8 Hrs)

Automated Inspection and Testing: Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods.

Programmable Logic Controllers (PLCs): Introduction, Micro PLC, Programming a PLC, Logic Functions, Input & Output Modules, PLC Processors, PLC Instructions, Documenting a PLC System, Timer & Counter Instructions, Typical PLC Programming Exercises for Industrial Applications.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain the inspection, testing methods and PLC's methods in automation. (L2)

TEXTBOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing", M. P. Grover, Pearson Education.

REFERENCE BOOKS:

1. "Computer Based Industrial Control", Krishna Kant, EEE-PHI
2. "Principles and Applications of PLC", Webb John, Mcmillan 1992
3. "An Introduction to Automated Process Planning Systems", Tiess Chiu Chang & Richard A. Wysk
4. "Anatomy of Automation", Amber G.H & P.S. Amber, Prentice Hall.

Course Code	RAPID PROTOTYPING		L	T	P	C
21A030504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- The fundamental Theory behind RP process.
- Study the Process parameters of different machine.
- Study different types of Rapid tooling.
- Based on the industrial standards, learn how Prepare manufacturing DATA.
- The basics concept of different software used in RP system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Theory behind RP process. **(K2)**
CO2: Learn the Process parameters of different machine. **(K3)**
CO3: Learn different types of Rapid tooling. **(K3)**
CO4: Understand the industrial standards; learn how to prepare manufacturing Data. **(K2)**
CO5: Understand basics concept of different software used in RP system. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	2	3	1	2	-	-	1	-	-	-	-
CO2	2	2	-	3	2	2	2	-	-	1	-	-	-	-
CO3	3	2	-	3	2	1	3	-	-	1	-	-	-	-
CO4	1	2	-	3	3	1	3	-	-	1	-	-	-	-
CO5	1	2	-	3	3	1	3	-	-	1	-	-	-	-

UNIT – I (9 Hrs)

Introduction & History of Rapid Prototyping, Fundamentals of Rapid Prototyping, Advantages and Disadvantages of Rapid Prototyping, Applications of Rapid Prototyping, Classification of RP, Rapid prototyping process chain, Fundamental Automated processes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know about the importance of rapid prototyping. (L1)
- Understand the concept of Stereo lithography. (L2)

UNIT – II (9 Hrs)

Stereo lithography (SLA) system & principle, Process parameter, process details of SLA, Data preparation, data files of SLA, Machine details & Application of SLA.

Selective Laser Sintering (SLS)- Introduction, SLS Machine Type – Details, SLS principle of operation, Process parameters of SLS, Data preparation for SLS.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about the selective laser sintering process. (L4)
- Explain about the concept of fused deposition modelling and solid ground curing. (L2)

UNIT – III (7 Hrs)

Fused Deposition Modeling (FDM) – Introduction, FDM Principles, Process Parameters, Path generation & Application of FDM, Solid Ground curing (SGC) - Principle of operation, SGC machine details & application. Laminate Object Manufacturing (LOM) - Principle of operation, LOM materials, LOM Process details & Application.

Learning Outcomes**:** At the end of this unit, students should be able to

- Demonstrate about laminated object manufacturing process. (L2)
- Know about different 3D modelling printing techniques. (L1)

UNIT – IV (10 Hrs)

Rapid tooling -Indirect rapid tooling, Silicon Rubber tooling, Aluminium filling epoxy tooling, Spray metal tooling, Direct rapid tooling, Quick cast process, copper Polyamide, DMILS – explanation, Prometals, sand casting tooling, Soft tooling & hard tooling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of rapid tolling. (L2)

UNIT – V (10 Hrs)

Rapid Manufacturing – Introduction, Factors influencing accuracy, Data preparation errors, Part building errors, Errors in finishing, Influence of build orientation.

Learning Outcomes**:** At the end of this unit, students should be able to

- Understand different file format software's of 3D modelling techniques. (L2)

TEXTBOOKS:

1. "Stereo lithography and other RP & M Technologies", Paul F. Jacobs, SME, NY 1996.
2. "Rapid Manufacturing", Flham D. T & Dinjoy S.S, Verlog London 2001.
3. "Rapid automated", Lament wood, Indus press New York.

REFERENCE BOOKS:

1. "Wohler's Report 2000", Terry Wohlers, Wohler's Association, 2000.
2. "Rapid prototyping materials", Gurumurthi, IISc Bangalore

<table>
<tr><td>Course Code</td><td rowspan="2">PRINCIPLES OF COMMUNICATION SYSTEMS</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A040503</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL | Semester</td><td colspan="4">VI</td></tr>
</table>

COURSE OBJECTIVES:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concept of amplitude modulation to solve engineering problems. **(K3)**
CO2: Analyze the Angle modulation & demodulation systems in time & frequency domains. **(K4)**
CO3: Analyze different Analog Pulse modulation & demodulation techniques. **(K4)**
CO4: Explain various digital modulation schemes. **(K3)**
CO5: Understand the concept of various communication systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Amplitude Modulation: An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of noise, Fourier transform, career modulation and frequency division multiplexing. (L2)
- Apply the concept of amplitude modulation to solve engineering problems. (L3)

UNIT – II (9 Hrs)

Angle Modulation: Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of angle modulation and its components. (L2)
- Apply the concept of frequency modulation to solve engineering problems. (L3)
- Analyse angle modulation schemes. (L4)
- Evaluate frequency modulation scheme in real time applications. (L4)

UNIT – III (8 Hrs)

Pulse Modulation: Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing. (L2)
- Explain various pulse modulation schemes. (L4)

UNIT – IV (9 Hrs)

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various digital modulation schemes. (L2)
- Analyze various digital modulation schemes. (L4)

UNIT – V (9 Hrs)

Communication Systems: Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various communication systems. (L2)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Principles of Communication Systems", Herbert Taub, Donald L Schilling and Goutam Saha, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

REFERENCE BOOKS:

1. "Modern Digital and Analog Communication Systems", B. P. Lathi, Zhi Ding and Hari M. Gupta, 4th Edition, Oxford University Press, 2017.

2. “Digital and Analog Communication Systems”, K. Sam Shanmugam, Wiley India Edition, 2008.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108104091
2. https://www.eeeguide.com/principles-of-communication-systems
3. https://ncert.nic.in/ncerts/l/leph207.pdf

Course Code	ELECTRONIC INSTRUMENTATION		L	T	P	C
21A040504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To introduce various measuring instruments and their functionality.
- To teach various measurement metrics for performance analysis.
- To explain principles of operation and working of different electronic instruments.
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.
- To provide exposure to different types of transducers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the different methods for measurement of various electrical quantities. **(K2)**
CO2: Compare the various measuring techniques for measuring voltage. **(K4)**
CO3: Measure amplitude and frequency utilizing oscilloscopes. **(K5)**
CO4: Analyze the functioning of various types of probes, derive the balanced condition for various bridges. **(K4)**
CO5: Measure various physical parameters by appropriately selecting the transducers. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (10 Hrs)

Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. **Ammeters:** DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. **Voltmeters and Multi-meters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of measurement system. (L2)
- Explain the characteristics of different Instruments. (L2)

- Illustrate different types of errors that may occur in instruments during measurements. (L2)

<u>UNIT – II</u> (9 Hrs)

Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM.

Digital Instruments: Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

Learning Outcomes: At the end of this unit, students should be able to

- Explain working of digital measuring Instruments. (L2)
- Compare the various measuring techniques for measuring voltage. (L4)

<u>UNIT – III</u> (9 Hrs)

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope.

Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator.

Learning Outcomes: At the end of this unit, students should be able to

- Measure parameters viz. Amplitude, frequency and time period using CRO. (L5)
- Classify signal generators and describe its characteristics. (L2)

<u>UNIT – IV</u> (8 Hrs)

Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger.

Bridges: Introduction, Wheatstone‘s bridge, Kelvin‘s Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell‘s bridge, Wien‘s bridge.

Learning Outcomes: At the end of this unit, students should be able to

- Describe function of various measuring Instruments. (L2)
- Describe how unknown capacitance and inductance can be measured using bridges. (L2)
- Select appropriate bridge for measuring R, L and C parameters. (L2)
- Analyze the functioning of various types of probes derive the balanced condition for various bridges. (L4)

<u>UNIT – V</u> (9 Hrs)

Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive

transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of transducer. (L2)
- Measure various physical parameters by appropriately selecting the transducers. (L5)

TEXTBOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, McGraw Hill, 3rd Edition, 2012, ISBN: 9780070702066.
2. "Modern Electronic Instrumentation and Measuring Techniques", A. D. Helfrick and W.D. Cooper, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

REFERENCE BOOKS:

1. "Electronic Instrumentation & Measurements", David A. Bell, Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.
2. "Electronics and Electrical Measurements", A. K. Sawhney, Dhanpat Rai &Sons. ISBN - 81-7700-016-0

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/108105064/
2. http://nptel.ac.in/courses/108105062/

OPEN ELECTIVE – III

<table>
<tr><td>Course Code</td><td rowspan="2">DISASTER MANAGEMENT AND MITIGATION</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A010503</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL | Semester</td><td colspan="4">VII</td></tr>
</table>

COURSE OBJECTIVES:

- To obtain the basic knowledge of Environmental Hazards and disasters.
- To understand the basics of Endogenous and Exogenous hazards and gives a suitable picture on the different types of hazard and disaster mitigation methods.
- To understand the key concepts of disaster management related to development and the relationship of different disaster management activities.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze and evaluate the environmental, social, cultural, economic, legal and organizational Aspects influencing vulnerabilities and capacities to face disasters and to know about different types of environmental hazards. **(K4)**

CO2: Compute knowledge on different types of natural and man- made disasters. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery). **(K3)**

CO3: Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ. **(K3)**

CO4: Identify endogenous and exogenous hazards their harmful effects to the environment, Case studies of India. **(K1)**

CO5: Identify the regulatory controls used in hazard management. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO2	3	3	3	3	-	-	2	1	-	-	2	-	2	-
CO3	3	3	3	3	-	-	2	2	-	-	2	-	2	-
CO4	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO5	3	3	2	3	-	-	2	1	-	-	2	-	3	-

UNIT – I (8 Hrs)

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Learning Outcomes: At the end of this unit, students should be able to

- Debate on the Knowledge of the disaster phenomenon, its different contextual aspects, impacts and public health consequences. (L5)
- Express about the natural hazards and its management. (L6)

UNIT – II (10 Hrs)

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

Learning Outcomes: At the end of this unit, students should be able to

- Explain the Capacity to manage the Public Health aspects of the disasters. (L4)
- Distinguish the different types of environmental hazards & disasters. (L5)

UNIT – III (9 Hrs)

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the regulations of building codes and land use planning related to risk and vulnerability. (L4)
- Justify the financial management of disaster and related losses. (L6)

UNIT – IV (9 Hrs)

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Mitigation and control measures of exogenous hazards. (L2)
- Analyze, and communicate information on risks, relief needs and order to formulate strategies for mitigation. (L4)

UNIT – V (9 Hrs)

Soil Erosion: - Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion-

Conservation measures of Soil Erosion. Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation. Biological hazards/ disasters:- Population Explosion.

Learning Outcomes: At the end of this unit, students should be able to

- Relate their interconnections, particularly in the field of the Public Health aspects of the disasters. (L3)
- Understand different approaches to prevent disasters. (L2)

TEXTBOOKS:

1. "Disaster Management", Rajib Shah, Universities Press, India, 2003
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Disaster Mitigation: Experiences and Reflections", Pardeep Sahni
4. "Natural Hazards & Disasters", Donald Hyndman & David Hyndman, Cengage Learning.

REFERENCE BOOKS:

1. "The Environment as Hazards", Kates, B.I & White, G.F, Oxford Publishers, New York, 1978
2. "Disaster Management", R.B. Singh (Ed), Rawat Publication, New Delhi, 2000
3. "Disaster Management", H.K. Gupta (Ed), Universities Press, India, 2003
4. "Space Technology for Disaster Mitigation in India (INCED)", R.B. Singh, University of Tokyo, 1994.

ONLINE LEARNING RESOURCES:

1. http://ndma.gov.in
2. http://www.ndrf.gov.in

Course Code	RENEWABLE ENERGY SYSTEMS		L	T	P	C
21A020505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand various alternate sources of energy for different suitable application requirements. **(K2)**
CO2: Understand the concepts of solar energy generation strategies and wind energy system. **(K2)**
CO3: Analyze Solar and Wind energy systems. **(K4)**
CO4: Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass, and fuel cells. **(K2)**
CO5: Understand the fundamentals of Solar and Wind energy systems. **(K2)**

CO-POMAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

Learning Outcomes: At the end of this unit, students should be able to

- Understanding renewable and nonrenewable energy resources. (L2)
- Understand the various forms of conventional energy resources. (L2)
- Understanding of Solar power properties. (L2)

UNIT – II (8 Hrs)

PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the PV cells and modules. (L2)
- Disseminate information on PV. (L3)

UNIT – III (10 Hrs)

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

Learning Outcomes: At the end of this unit, students should be able to

- Understanding of wind energy production. (L2)
- Outline division aspects and utilization of renewable energy sources for both domestics and industrial application. (L3)
- Understand the need of Wind Energy and the various components used in energy generation and know the classification. (L2)

UNIT – IV (8 Hrs)

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the Resources of geothermal energy.(L2)

UNIT – V (10 Hrs)

Miscellaneous Energy Technologies: Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Biomass energy resources and their classification. (L2)

- Analyze the performance of Ocean Energy. (L4)

TEXTBOOKS:

1. "Renewable Energy Power for a Sustainable Future", Stephen Peake, Oxford International Edition, 2018.
2. "Non-Conventional Energy Sources", G. D. Rai, Khanna Publishers, 4th Edition, 2000.

REFERENCE BOOKS:

1. "Solar Energy", S. P. Sukhatme, Tata Mc Graw Hill Education Pvt. Ltd, 3rd Edition, 2008.
2. "Non-Conventional Energy Resources", B H Khan, Tata Mc Graw Hill Education Pvt Ltd, 2nd Edition, 2011.
3. "Non-Conventional Energy Resources", S. Hasan Saeed and D. K. Sharma, S. K. Kataria & Sons, 3rd Edition, 2012
4. "Renewable Energy Resource: Basic Principles and Applications", G. N. Tiwari and M. K. Ghosal, Narosa Publishing House, 2004

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

Course Code	CONCEPTS OF ELECTRICAL DRIVES AND APPLICATIONS		L	T	P	C
21A020506			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the choice of the electric drive system based on their applications. **(K2)**

CO2: Explain the operation of single and multi-quadrant electric drive. **(K3)**

CO3: Analyze single phase and 3-phase rectifiers fed DC motors and chopper fed DC motors. **(K4)**

CO4: Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors with closed loop, and open loop operations. **(K3)**

CO5: Explain the speed control methods for AC-AC & DC-AC converters fed to Synchronous motors with closed loop, and open loop operations. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Converter Fed DC Motors: Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase semi and fully controlled converters connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic electrical drive elements and its function. (L2)
- Analyze the single-phase dc drives and its speed-torque characteristics. (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

<u>UNIT – II</u> (9 Hrs)

Four Quadrant Operation of DC Drives: Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the four-quadrant operation of the dc drives. (L2)
- Analyze the various motoring and braking operations of the dc motors. (L4)
- Understand the closed loop operation of the dc drives. (L2)

<u>UNIT – III</u> (9 Hrs)

Chopper fed DC Motors: Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics– Problems on Chopper Fed D.C Motors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basics concepts of choppers and its operation. (L2)
- Analyze the classification of various choppers feeding the dc drives. (L4)

<u>UNIT – IV</u> (9 Hrs)

Control of Induction Motor: Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers–Waveforms – Speed Torque Characteristics - Stator Frequency Control and characteristics. Voltage Source and Current Source Inverter – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Static Rotor Resistance Control

Learning Outcomes: At the end of this unit, students should be able to

- Understand the various speed control methods of induction motor used in drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods to induction motor on rotor side. (L3)

<u>UNIT – V</u> (9 Hrs)

Control of Synchronous Motors: Separate Control & Self Control of Synchronous Motors – Operation of Self-Controlled Synchronous Motors by VSI and CSI. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque Characteristics – Applications – Advantages.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the self and separate control methods of synchronous motor drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods of synchronous motors. (L4)

TEXTBOOKS:

1. “Power semiconductor-controlled drives”, G K Dubey, Prentice Hall, 1995.
2. “Modern Power Electronics and AC Drives”, B. K. Bose, PHI, 2002.

REFERENCE BOOKS:

1. “Power Electronics”, MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. “Power Electronic Circuits, Devices and applications”, M. H. Rashid, PHI, 2005.
3. “Electric drives Concepts and Applications”, Vedam Subramanyam, Tata McGraw Hill Publications, 2^{nd} Edition, 2011.

Course Code	OPTIMIZATION TECHNIQUES		L	T	P	C
21A030505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the basic fundamentals of optimization methods that can be used during a design process.
- To expose the students to different modern optimization techniques.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand basic theoretical principles of optimization models and its solution. **(K2)**
CO2: Formulate the given practical problem and solving by graphical /simplex method. **(K3)**
CO3: Analyse the cost for transportation and assigning the jobs to machines. **(K3)**
CO4: Analyse the cost and duration of the project, also preparation of job scheduling. **(K3)**
CO5: Use latest methods for optimization. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	1	2	2	1	-	-
CO2	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO3	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO4	3	3	3	3	-	2	-	1	1	-	2	1	-	-
CO5	3	3	3	3	2	2	-	-	2	-	2	1	-	-

UNIT – I (10 Hrs)

Introduction to Optimization: Classification of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems.

Classical Optimization Techniques: Single variable optimization, Multi-variable: Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain how to formulate statement of optimization problem with or without constraints. (L3)
- Explain about classification of single and multivariable optimization problems. (L3)
- Know about necessary and sufficient conditions in defining the optimization problems. (L1)
- Understand how to formulate Kuhn-Tucker conditions and to solve numerical problems. (L3)

UNIT – II (8 Hrs)

Linear Programming: Statement of an LP problem, Graphical Solution of an LP problem, Simplex method, Two phase method, Dual simplex method.

Learning Outcomes: At the end of this unit, students should be able to

- Formulation of problem as LPP. (L4)
- Solve numerical problems with graphical method, Simplex method, two phase method and dual simplex method. (L4)

UNIT – III (9 Hrs)

Transportation Problems: Introduction, Optimal Solution for BFS, Unbalanced Transportation Problem, Transshipment, Assignment Problems, Hungarian Method.

Learning Outcomes**:** At the end of this unit, students should be able to

- Model linear programming problems like the transportation. (L6)
- Solve the problems of transportation from origins to destinations with minimum time and cost. (L3)
- Solve assignment problems. (L4)

UNIT – IV (10 Hrs)

Project Management: Introduction, Critical Path Method, Critical Path Determination, Optimal Scheduling by CPM, Project Evaluation and Review Technique.

Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

Learning Outcomes: At the end of this unit, students should be able to

- Represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project. (L4)
- Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability. (L4)
- Solve problems of production scheduling. (L3)

UNIT – V (8 Hrs)

Modern Methods of Optimization: An overview of evolutionary algorithms, Genetic algorithms, simulated annealing, fuzzy optimization, neural-network based methods, Particle swarm optimization.

Learning Outcomes**:** At the end of this unit, students should be able to

- Solve the numerical problems using modern optimization techniques. (L4)

TEXTBOOKS:

1. "Engineering Optimization- Methods and Applications", A. Ravindran, K. M. Ragsdell, G.V. Reklaitis, Wiley India Edition, 2nd Edition.
2. "Operations Research: An Introduction", H.A. Taha, PHI Pvt. Ltd., 6th Edition

REFERENCE BOOKS:

1. "Introduction to Optimum Design", J S Arora, Mc-Graw Hill.
2. "Optimization Methods for Engineering Design", Fox, R. L., Addison Wesley, 2001.
3. "Multi-objective optimization using evolutionary algorithms", K Deb John Wiley Publications.
4. "Operations Research", Dr. J. K. Sharma, Mc Millan.
5. "Engineering Optimization: Theory and Practice", Singiresu S. Rao, John Wiley & Sons

<table>
<tr><td>Course Code</td><td rowspan="2">GLOBAL WARMING AND CLIMATE CHANGES</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A030506</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="3">VII</td></tr>
</table>

COURSE OBJECTIVES:

- To know the basics, importance of global warming.
- To know the concepts of mitigation measures against global warming
- To know the impacts of climate changes

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know the impact of Ozone layer on green house effect and global warming. **(K1)**
CO2: Understand the structure of atmosphere and effects of inversion on pollution dispersion. **(K2)**
CO3: Know the effect of global warming and climatic changes on environment. **(K1)**
CO4: Understand Global change in temperature and climate and measures to reduce the effect. **(K2)**
CO5: Understand the clean technology, use of renewable energy, mitigation technologies and their practices **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO5	1	2	-	2	-	-	-	-	2	-	-	2	-	-

UNIT – I (7 Hrs)

EARTH'S CLIMATE SYSTEM:

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Green house gases and green house effect, Hydrological cycle and Carbon cycle, Global warming and its impacts

Learning Outcomes: At the end of this unit, students should be able to

- Identity the importance of Ozone and effect of green house gases. (L1)
- Know the effect of global warming. (L1)

UNIT – II (9 Hrs)

ATMOSPHERE & ITS COMPONENTS: Atmosphere and its layers-Characteristics of Atmosphere - Structure of Atmosphere - Composition of Atmosphere - Atmospheric stability -

Temperature profile of the atmosphere - Temperature inversion and effects of inversion on pollution dispersion.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the layers of atmosphere and their characteristics. (L1)

UNIT – III (8 Hrs)

IMPACTS OF CLIMATE CHANGE: Causes of Climate change - Change of Temperature in the environment - Melting of ice and sea level rise - Impacts of Climate Change on various sectors - Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and its effects on various sectors. (L1)

UNIT – IV (10 Hrs)

OBSERVED CHANGES AND ITS CAUSES: Climate change and Carbon credits-Clean Development Mechanism (CDM), CDM in India - Kyoto Protocol - Intergovernmental Panel on Climate Change (IPCC) - Climate Sensitivity - Montreal Protocol - United Nations Framework Convention on Climate Change (UNFCCC) - Global change in temperature and climate and changes within India

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and carbon credits, effect of change in temperature and climate on India. (L1)

UNIT – V (11 Hrs)

CLIMATE CHANGE AND MITIGATION MEASURES: CDM and Carbon Trading - Clean Technology, biodiesel, compost, biodegradable plastics - Renewable energy usage as an alternative - Mitigation Technologies and Practices within India and around the world - Non-renewable energy supply to all sectors - Carbon sequestration - International and regional cooperation for waste disposal biomedical wastes, hazardous wastes, e-wastes, industrial wastes, etc.,

Learning Outcomes: At the end of this unit, students should be able to

- Know about the clean technology, use of renewable energy, mitigation technologies and their practices. (L1)

TEXTBOOKS:

1. "Climate Change – An Indian Perspective", Dash Sushil Kumar, Cambridge University Press India Private limited 2007.

REFERENCE BOOKS:

2. "Adaptation and mitigation of climate change-Scientific Technical Analysis", Cambridge University Press, Cambridge, 2006.
3. "Atmospheric Science", J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
4. "Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Jan C. van Dam, Cambridge university press, 2003.
5. "Global Warming: Understanding the Forecast"", David Archer, Wiley, 2nd Edition, 2011
6. "Global Warming: The Complete Briefing", John Houghton, Cambridge University Press, 5th Edition, 2015

Course Code	ELECTRONIC SENSORS		L	T	P	C
21A040505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To learn the characterization of sensors.
- To know the working of Electromechanical, Thermal, Magnetic and radiation sensors
- To understand the concepts of Electro analytic and smart sensors
- To be able to use sensors in different applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the Principles of different sensors, Characterization and working of Electro mechanical Sensors. **(K3)**
CO2: Analyze the working of Thermal sensors. **(K4)**
CO3: Compare the working of magnetic resistor and hall effect sensors. **(K4)**
CO4: Explain the working of radiation and Electro analytic Sensors. **(K3)**
CO5: Develop a system with smart sensors. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (9 Hrs)

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of sensors/Transducers principles. (L2)
- Understand the concepts of Electro mechanical sensors. (L2)
- Identify the operation of Inductive and capacitive sensors. (L3)

UNIT – II (9 Hrs)

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Thermal sensors. (L2)
- Understand the working of Thermal radiation sensors. (L2)
- Identify the types of semiconductor sensors. (L3)
- Analyse the operation of heat flux sensors. (L4)

UNIT – III (9 Hrs)

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principles of Magnetic sensors. (L2)
- Summarize the concepts of Angular transducers. (L2)
- Compare the working of magnetic resistor and Hall effect sensors. (L4)

UNIT – IV (9 Hrs)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors, Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of radiation sensors. (L2)
- Summarize the types of photo detectors. (L2)
- Explain different electrodes and sensors. (L3)

UNIT – V (9 Hrs)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart

Sensor Interface, the Automation Sensors –Applications, Introduction- On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of smart sensors. (L2)
- Summarize the applications of automation sensor. (L2)
- Develop different sensors used in the industries and manufacturing. (L3)

TEXTBOOKS:

1. “Sensors and Transducers”, D. Patranabis, PHI Learning Private Limited., 2003.
2. “Introduction to sensors”, John veteline, Aravind Raghu, CRC press, 2011

REFERENCE BOOKS:

1. “Sensors and Actuators”, D. Patranabis, PHI, 2nd Edition, 2013.
2. “Make sensors”, Tero Karvinen, Kimmo Karvinen and Ville Valtokari, Maker media, 1st Edition, 2014.
3. “Sensors handbook”, Sabrie Soloman, TMH, 2nd Edition, 2009

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108147
2. http://www.nitttrc.edu.in/nptel/courses/video/101104066/101104066.html

Course Code	INTRODUCTION TO IMAGE PROCESSING		L	T	P	C
21A040506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce fundamentals of Image Processing.
- To expose various intensity transformations in spatial and frequency domains.
- To impart concepts of wavelets and various coding techniques for image compression.
- To dissimilate various segmentation techniques for images.
- To teach various color models and to introduce the concepts of color image segmentation.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various types of images mathematically. **(K4)**
CO2: Compare image enhancement methods in spatial and frequency domains. **(K3)**
CO3: Apply various segmentation algorithms for processing an image. **(K3)**
CO4: Categorize various compression techniques and color models. **(K4)**
CO5: Apply various techniques for color image smoothing, sharpening and segmentation. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO4	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels: neighbourhood, adjacency, connectivity, distance measures. Mathematical tools/ operations applied on images.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic building blocks of image processing. (L2)
- Define image processing parameters such as adjacency and distance measures. (L1)
- Analyze various types of images mathematically. (L4)

UNIT – II (9 Hrs)

Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Learning Outcomes: At the end of this unit, students should be able to

- Apply spatial domain and frequency Domain filtering techniques for image enhancement (L3)
- Compare image enhancement methods in spatial and frequency domains. (L3)

<u>UNIT – III</u> (9 Hrs)

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various Image segmentation techniques. (L2)
- Illustrate detection of discontinuities in an image. (L2)
- Apply various segmentation algorithms for processing an image. (L3)

<u>UNIT – IV</u> (9 Hrs)

Image Compression: Redundancy, inter-pixel and psycho-visual; Loss less compression- predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various transform techniques for lossy compression. (L2)
- Apply various coding techniques for lossless compression. (L3)

<u>UNIT – V</u> (9 Hrs)

Color Image Processing: Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various color models for color image processing. (L2)
- Apply various techniques for color image smoothing, sharpening and segmentation. (L3)

<u>TEXTBOOKS:</u>

1. "Digital Image Processing", R.C. Gonzalez and R.E. Woods, Pearson Education, 2^{nd} Edition, 2008.
2. "Fundamentals of Digital Image Processing", Anil Kumar Jain, Prentice Hall of India, 2^{nd} Edition 2004.

REFERENCE BOOKS:

1. "Digital Image processing using MATLAB", Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Tata McGraw Hill, 2010.
2. "Image Processing, Analysis, and Machine Vision", Milan Sonka, Vaclav Hlavac, Roger Boule, Cengage Learning, 3rd Edition, 2016.
3. "Digital Image processing", S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.
4. "Digital Image Processing", William K. Pratt, John Wiley, 3rd Edition, 2004.

ONLINE LEARNING RESOURCES:

1. https://www.udemy.com/course/learn-image-analysis/
2. https://alison.com/tag/image-processing
3. https://nptel.ac.in/courses/117/105/117105135/

OPEN ELECTIVE – IV

Course Code	COST EFFECTIVE HOUSING TECHNIQUES		L	T	P	C
21A010504			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To train the students to have a comprehensive knowledge of planning, design, evaluation, construction
- To train the students to financing of housing projects
- To Provide Knowledge on cost effective construction materials and methods.
- To teach the principles of sustainable housing policies and programmes.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand about planning, design, evaluation, construction and financing of housing projects with cost effective housing techniques. **(K2)**

CO2: Choose the basic housing programmes and services and slum improvement and relocation. **(K3)**

CO3: The student can be in a position to adopt the suitable techniques in construction of low cost constructions. **(K6)**

CO4: Understand about alternate building materials for low cost housing techniques and sanitation services in rural areas. **(K2)**

CO5: The student can be in a position to analyze the suitable techniques in rural and disaster prone areas by using locally available materials. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

INTRODUCTION TO HOUSING: Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the about basics about housing norms. (L4)

- Understand the objectives and strategies of housing policies. (L2)

UNIT – II (9 Hrs)

HOUSING PROGRAMMES: Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate the usage of GIS and MIS in housing projects. (L4)
- Explain about development of plots and gated communities. (L4)

UNIT – III (9 Hrs)

DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY: Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements - Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall - Fly ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

Learning Outcomes: At the end of this unit, students should be able to

- Write about the adoption of Economical Wall System. (L6)
- Write about Adoption of precast R.C. plank and join system for roof/floor in the building. (L6)

UNIT – IV (9 Hrs)

ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING AND INFRASTRUCTURE SERVICES IN RURAL HOUSES: Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Low cost Infrastructure services: Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy. Rural Housing**:** Introduction traditional practice of rural housing continuous - Mud Housing technology-Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs.

Learning Outcomes: At the end of this unit, students should be able to

- Determine about alternate building materials for low cost housing construction. (L3)
- Justify about low cost sanitation from traditional methods. (L6)

UNIT – V (9 Hrs)

HOUSING IN DISASTER PRONE AREAS: Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirements of structural safety of thin pre-cost roofing units against Earthquake forces -Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about Type of Damages and Railways of non-engineered buildings. (L4)
- Express about Repair and restore action of earthquake Damaged structures and for future constructions. (L6)

TEXTBOOKS:

1. "Hand book of Low Cost Housing", A. K. Lal, New Age International publishers.
2. "Low Cost Housing", G.C. Mathur, IBH Publishers.
3. "Housing in India", Francis Cherunilam and Odeyar D Heggade, Himalaya Publishing House, Bombay, 1997.

REFERENCE BOOKS:

1. "Disaster Management", Rajib Shaw, Universities Press, India.
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Building Materials For Low–Income Houses", International Council For Building Research Studies And Documentation.
4. "Modern Trends In Housing In Developing Countries", A.G. Madhava Rao, D.S. Rama Chandra Murthy & G. Annamalai.
5. "Properties of Concrete"', Neville A.M. Pitman Publishing Limited, London.
6. "Light Weight Concrete", Academic Kiado, Rudhai.G, Publishing home of Hungarian Academy of Sciences, 1963.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/124107001
2. https://nptel.ac.in/courses/105103206
3. https://onlinecourses.nptel.ac.in/noc20_ar14/preview4

Course Code	ENERGY CONSERVATION AND MANAGEMENT		L	T	P	C
21A020507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Familiarize present energy scenario, and energy auditing methods.
- Explain components of electrical systems, lighting systems and improvements in performance. Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
- Train on energy conservation in major utilities.
- Instruct principles of energy management and energy pricing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain Energy Utilization and Energy Auditing Methods. **(K3)**

CO2: Analyse Electrical Systems Performance of Electric Motors and Lighting Systems. **(K4)**

CO3: Examine Energy Conservation Methods in Thermal Systems. **(K3)**

CO4: Estimate Efficiency of Major Utilities Such as Fans, Pumps, Compressed Air Systems, Havoc and D.G. Sets. **(K2)**

CO5: Elaborate Principles of Energy Management, Programs, Energy Demand and Energy Pricing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction: Energy – Power – Past & Present Scenario of World; National Energy Consumption Data – Environmental Aspects Associated with Energy Utilization –Energy Auditing: Need, Types, Methodology And Barriers. Role of Energy Managers, Instruments for energy auditing.

Learning Outcomes: At the end of this unit, students should be able to

- Infer energy consumption patterns and environmental aspects of energy utilization. (L4)
- Outline energy auditing requirements, tools, and methods. (L3)
- Identify the function of energy manager. (L2)

UNIT – II (9 Hrs)

Electrical Systems: Components of EB Billing – HT And LT Supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of Lighting, Efficacy, LED Lighting And Scope Of Economy In Illumination.

Learning Outcomes: At the end of this unit, students should be able to

- Outline components of electricity billing, transmission, and distribution. (L3)
- Analyse performance characteristics of transformers, capacitors, and electric motors. (L4)
- Examine power factor improvements, and electric motor efficiency. (L3)
- Evaluate lighting systems. (L4)

UNIT – III (9 Hrs)

Thermal Systems: Stoichiometry, Boilers, Furnaces, and Thermic Fluid Heaters – Efficiency Computation and Encon Measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, and Insulators & Refractory's.

Learning Outcomes: At the end of this unit, students should be able to

- Determine efficiency of boilers, furnaces, and other thermal systems. (L3)
- Recommend energy conservation measures in thermal systems. (L2)
- Justify steam systems in energy conservation. (L3)

UNIT – IV (9 Hrs)

Energy Conservation in Major Utilities: Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. Sets.

Learning Outcomes: At the end of this unit, students should be able to

- Explain energy conservation measures in major utilities. (L3)
- Apply performance test criteria for fans, pumps, compressors, havoc systems. (L3)
- Assess energy conservation in cooling towers and D.G. sets. (L3)

UNIT – V (9 Hrs)

Energy Management: Principles of Energy Management, Energy demand estimation, Organizing and Managing Energy Management Programs, Energy pricing.

Learning Outcomes: At the end of this unit, students should be able to

- Describe principles of energy management. (L2)
- Assess energy demand and forecast, organize energy management programs. (L3)
- Design elements of energy pricing. (L5)

TEXTBOOKS:

1. "Energy Manager Training Manual", A Website Administered by Bureau of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government of India, 2004, 4 Volumes Available at ww.energymanagertraining.com

REFERENCE BOOKS:

1. "Industrial Energy Management and Utilisation", Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988.
2. "Design and Management for Energy Conservation", Callaghn, P.W., Pergamon Press, Oxford, 1981
3. "The Efficient Use of Energy", Dryden. I.G.C., Butter worths, London, 1982
4. "Energy Management", Murphy. W. R. and G. Mc Kay, Butter worths, London 1987

Course Code	BASICS OF POWER ELECTRONICS		L	T	P	C
21A020508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operation, characteristics, and usage of power semiconductor devices. **(K2)**
CO2: Understand different types of Rectifier circuits with different operating conditions. **(K2)**
CO3: Understand DC-DC converters operation and analysis of their characteristics. **(K2)**
CO4: Understand the construction and operation of voltage source inverters. **(K2)**
CO5: Apply all the above concepts to solve various numerical problem solving. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	1	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-	1	-

UNIT – I (9 Hrs)

Power Switching Devices: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

Learning Outcomes: At the end of this unit, students should be able to

- Know the V-I characteristics of different semi-conductor devices. (L4)
- Importance of drive circuit for MOSFET, IGBT and GTO. (L3)

UNIT – II (9 Hrs)

Rectifiers: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance.

Learning Outcomes: At the end of this unit, students should be able to

- Derivation of expressions of different configurations of rectifiers. (L3)
- Calculate the Average, R.M.S values of Voltages and Currents. (L4)

UNIT – III (8 Hrs)

DC-DC converters: Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of duty cycle. (L2)
- Analysis of waveforms at steady state of power circuit. (L4)
- Derivation of average output voltage of DC-DC converter. (L3)

UNIT – IV (9 Hrs)

Inverter: Single phase Voltage Source inverters– operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters –Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle operationally.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of pulse width modulation. (L2)
- Analysis of waveforms of single phase and three phase bridge inverters. (L4)

UNIT – V (10 Hrs)

AC voltage controllers & Cyclo converters: voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of TRIAC – TRIAC with R and RL loads– RMS load voltage, current and power actor-waveforms. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down Cyclo converters with Resistive load, Principle of operation, Waveforms, output voltage.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of the phase control and integral cycle control. (L2)
- Know the principal operation of voltage and frequency converter. (L4)
- Analysis waveforms of ac voltage converter and Cyclo converter. (L4)

TEXTBOOKS:

1. "Power Electronics: Circuits, Devices and Applications", M. H. Rashid, Prentice Hall of India, 2nd Edition, 1998

2. “Power Electronics”, P. S. Bimbhra, Khanna Publishers, 4th Edition, 2010.
3. “Power Electronics”, M. D. Singh & K. B. Khanchandani, Tata Mc Graw Hill Publishing Company, 1998.

REFERENCE BOOKS:

1. “Power Electronics”, Ned Mohan, Wiley, 2011
2. “Fundamentals of Power Electronics”, Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004
3. “Power Electronics”, Vedam Subramanyam, New Age International (P) Limited, 1996.
4. “Power Electronics”, V. R. Murthy, Oxford University Press, 1st Edition, 2005.
5. “Power Electronics”, P. C. Sen, Tata Mc Graw-Hill Education, 1987
6. “Power Electronic Control of Alternating Current Motors”, J. M. D. Murphy.

Course Code	BASICS OF AUTOMOTIVE ENGINEERING		L	T	P	C
21A030507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce various components of an automobile and engine sub systems.
- To impart knowledge on various safety systems of an automobile and emission norms.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the various components of an automobile and Working of fuel supply system. **(K2)**
CO2: Know the working of various lubrication and cooling systems. **(K1)**
CO3: Familiarize with the various systems such as ignition system and transmission system. **(K2)**
CO4: Explain the suspension, braking systems of an automobile and their differences. **(K2)**
CO5: Know about the emissions from engine and safety norms for the operation of an automobile. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction: classification of automobiles, Components of four wheeler automobile- chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive

Fuel supply systems: simple fuel supply system in petrol and diesel engines. Working of simple Carburetor, direct fuel injection system in diesel engine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the parts of automobile engines. (L2)
- Understand the concept of fuel supply systems. (L2)

UNIT – II (7 Hrs)

Lubricating System: Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.

Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the function of Lubricating system. (L3)

UNIT – III (10 Hrs)

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, Electronic ignition system.

Transmission system: Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, Types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the concept of Ignition system and its types. (L2)
- Understand the concept of Transmission system. (L2)

UNIT – IV (10 Hrs)

Suspension System: Objectives of suspension system, front suspension system rigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the working of suspension system and its types. (L2)
- Analyze the different types of braking systems. (L3)

UNIT – V (9 Hrs)

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. Engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand emission concept in automobiles engines. (L2)
- Understand the concept of safety system. (L2)

TEXTBOOKS:

1. "Automobile Engineering Vol-1 & vol-2", Kirpal Singh, Standard Publishers Distributors, 11th Edition.
2. "Automotive Mechanics", William H Crouse & Donald LAnglin, Tata Mc Graw Hill Publications, 10th Edition.

3. "Automobile Engineering", Rajput, Laxmi Publications.

REFERENCE BOOKS:

1. "Automobile Engineering", R.B Gupta, Satya Prakashan Publications, 6th Edition.
2. "The Motor vehicle", Newton steeds & Garrett, Society of Automotive Engineers, 13th Edition.
3. "Automotive Engineering", G.B.S. Narang, Khanna Publishers, 5th Edition.
4. "Automotive Mechanics", Joseph Heitner, IPC Transport Press Ltd, 2nd Edition.
5. "The Automobile", Harbans Singh Reyat, S. Chand & company Pvt. Ltd., 6th Edition.

Course Code	BASICS OF TOTAL QUALITY MANAGEMENT		L	T	P	C
21A030508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concept of quality, cost of quality, international quality standards.
- To learn the principles of Total quality management, techniques for problem solving.
- To learn about various tools of quality management used in various industrial applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts of Quality and Quality Control Techniques. **(K2)**
CO2: Understand TQM concepts and History and able to use quality tools for problem solving. **(K2)**
CO3: Use TQM techniques and to formulate quality circles to find solutions with team work. **(K2)**
CO4: Apply various TQM Methods to solve problems in industry. **(K3)**
CO5: Analyze various quality problems and contribute towards continuous improvement in the system. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	2	-	2	2	2	-	2	-	-	-	2	-	-
CO5	1	-	-	-	-	2	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Inspection & Quality Control

Statistical Quality Control (SQC) – Techniques - variables and attributes Control charts : $\bar{X}$ - R Charts, P-Chart, C-Chart. Acceptance Sampling – Single and Double sampling Plan - OC Curves. BIS and ISO Standards – Importance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Control charts: $\bar{X}$ - R Charts, P-Chart, C-Chart, single and double sampling plans and BIS&ISO standards. (L1)

UNIT – II (8 Hrs)

TQM – concepts, History-Quality management philosophies-Juran, Deming, Crosby, Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – internal and external customers - TQM tools & techniques- 7 QC tools- 7 New QC tools.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various quality management philosophies, Evaluation of TQM, TQM tools and technologies. (L1)

UNIT – III (10 Hrs)

Problem solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis, Quality circles – organization – team approach.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse Problem solving process, system failure analysis, fault tree analysis, pedigree analysis and concept Quality circles. (L4)

UNIT – IV (10 Hrs)

Quality Function Development (QFD) – elements of QFD –benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Know the procedure for quality function development, bench marking, taguchi analysis. (L1)

UNIT – V (8 Hrs)

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management, Six sigma approach – application of six sigma approach to various industrial situations.

Learning Outcomes: At the end of this unit, students should be able to

- Know the value improvement, supplier teaming and the concept of business process re-engineering, supply chain management and six sigma. (L1)

TEXTBOOKS:

1. "Total Quality Management", D.R.Kiran, BS Publications, 2016
2. "Total Quality Management", Bester field, Pearson.

REFERENCE BOOKS:

1. "Quality management", Howard Giltow, TMH
2. "Quality management", Evans.
3. "Quality management", Bedi
4. "Total Quality Management", Joseph & Susan Berg
5. "Total Quality Management-Toward the Emerging Paradigm", Bounds, Yorks, Adams, Ranney, McGraHill, 1994

Course Code	PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS		L	T	P	C
21A040507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyze cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts and operation of cellular systems. **(K2)**

CO2: Apply the concepts of co-channel interference & Cell splitting to solve engineering problems. **(K3)**

CO3: Compare different Handoffs. **(K4)**

CO4: Compare various types of multiple access techniques. **(K4)**

CO5: Evaluate suitability of a cellular system in real time applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	3

UNIT – I (10 Hrs)

Introduction to Cellular Mobile Systems: Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts and operation of cellular systems. (L2)
- Explain the characteristics of mobile radio environment. (L2)

UNIT – II (8 Hrs)

Cellular Radio System Design: General description of the problem, Concept of frequency reuse channels, Co-channel interference reduction, Desired C/I ratio, Cell splitting and sectoring, Microcell zone concept.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of frequency reuse and co-channel interference in cellular systems. (L2)
- Apply the concept of cellular systems to solve engineering problems. (L3)
- Explain the design problems of cellular systems. (L3)

UNIT – III (10 Hrs)

Handoffs and Dropped Calls: Why handoffs and types of handoffs, Initiation of handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Inter system handoff. Introduction to dropped call rate.

Learning Outcomes: At the end of this unit, students should be able to

- Understand why handoff is required. (L2)
- Apply handoff techniques to solve engineering problems. (L3)
- Compare various types of handoffs. (L4)

UNIT – IV (8 Hrs)

Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various types of multiple access techniques. (L2)
- Apply the concept of multiple access to solve engineering problems. (L3)
- Compare various types of multiple access techniques. (L4)

UNIT – V (9 Hrs)

Digital Cellular Systems: Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

Learning Outcomes: At the end of this unit, students should be able to

- Understand operation of various types of digital cellular systems. (L2)
- Compare various types of digital cellular systems. (L2)
- Evaluate suitability of a cellular system in real time applications. (L4)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Mobile Cellular Tele communications", William C.Y.Lee, McGraw – Hill International, 2nd Edition, 1995.
2. "Wireless Communications–Principles and Practice", Theodore S. Rappaport, PHI, 2nd Edition, 2004.

REFERENCE BOOKS:

1. "Principles of Modern Wireless Communications Systems –Theory and Practice", Aditya K. Jagannatham, McGraw – Hill International, 2015.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117102062
2. https://www.electronicshub.org/wireless-communication-introduction-types-applications/

Course Code	EMBEDDED SYSTEMS		L	T	P	C
21A040508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the basics of an embedded system
- To introduce the typical components of an embedded system
- To explain various communication interfaces used in embedded system
- To provide knowledge on the design process of embedded system applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Discuss the basic concepts of an embedded system. **(K3)**

CO2: Explainthe role of system core, memory, sensors, actuators, I/O and other sub system components in an embedded system. **(K3)**

CO3: Explain the different communication interfaces of an embedded system. **(K3)**

CO4: Illustrate about the interrupt service mechanism and device drivers. **(K3)**

CO5: Write aboutvarious steps involved in design and development of embedded firmware. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

Introduction to Embedded Systems: Definition, Embedded systems Vs General computing systems, History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

Learning Outcomes: At the end of this unit, students should be able to

- Classify embedded systems based on generation, complexity and performance. (L2)
- Discuss the characteristics of an embedded system. (L2)
- Explain the design process in embedded system. (L3)

UNIT – II (9 Hrs)

Typical Embedded System: Core of the embedded system, Memory-ROM, RAM, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer, PCB and passive components

Learning Outcomes: At the end of this unit, students should be able to

- Discuss about the core of the embedded system. (L2)
- Summarize different factors to be considered in the selection of memory for an embedded system. (L2)
- Explain the role of sensors, actuators, I/O components and other subsystem components used in embedded system. (L3)

UNIT – III (9 Hrs)

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various types of on-board communication interfaces. (L3)
- Describe the external communication interfaces used in embedded system. (L2)
- Discuss the different types of wireless communication interfaces used in embedded system. (L2)

UNIT – IV (9 Hrs)

Device drivers and Interrupt Service Mechanism: Programmed I/O busy-wait approach without interrupt service mechanism, Interrupt-driven I/O, interrupt service routine concept, interrupt sources, hardware interrupts, software interrupts, interrupt-servicing mechanism, multiple interrupts, interrupt service threads as second-level interrupt handlers, context and the periods for context switching, interrupt latency, interrupt-service deadline, interrupt service mechanism form context-saving angle, Device driver programming.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize pros and cons of interrupt driven data transfer. (L2)
- Illustrate hardware and software interrupts with examples. (L3)
- Know how interrupts can be used to minimize latency. (L3)
- Describe uses of hardware and software assigned priorities in an interrupt service mechanism. (L2)
- Differentiate ISRs & device driver functions. (L2)

UNIT – V (8 Hrs)

Embedded Firmware Design and Development: Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the different approaches for embedded firmware design. (L2)
- Discuss the different embedded firmware development languages. (L2)
- Explain the process of Assembly language to machine language conversion and High-level language to machine language conversion. (L3)
- Write about various steps involved in design and development of embedded firmware. (L3)

TEXTBOOKS:

1. "Introduction to Embedded Systems", Shibu. K.V., McGraw Hill Education, 2nd Edition, 2017.
2. "Embedded Systems: Architecture, Programming and Design", Raj Kamal, McGraw Hill Education, 3rd Edition, 2017

REFERENCE BOOKS:

1. "Computers as Components", Wayne Wolf, Morgan Kaufmann, Elsevier, 2nd Edition
2. "Embedded Systems- An integrated approach", Lyla B Das, Pearson education, 2012
3. "Embedded Microcomputer Systems Real Time Interfacing", Jonathan W.Valvano, Cengage Learning, 3rd Edition, 2012.

HONOURS

Course Code	ADVANCED COMPUTER NETWORKS (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN01			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand computer network architectures, protocols, and interfaces.
- The OSI reference model and the Internet architecture network applications.
- Expose students to the concepts of traditional as well as modern day computer networks - wireless and mobile, multimedia-based.
- To understand the key concepts and practices employed in modern computer networking

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Summarize the network performance or network types. **(K2)**
CO2: Illustrate switching, transferring and address classifications of networks. **(K3)**
CO3: Calculate IP addresses and apply link layer protocols. **(K3)**
CO4: Analyze the internet working functionalities. **(K4)**
CO5: Classify application layer functionalities or multimedia applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (12 Hrs)

Network Architecture, Performance: Bandwidth and Latency, High Speed Networks, Network-Centric View, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks, Overlay Networks: Routing Overlays, Peer-to-Peer Networks and Content Distribution Networks, Client-Server Networks, Delay Tolerant Networks

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network performance. (L1)
- Differentiate the different types of networks. (L2)
- Identify the reliable and unreliable networks. (L1)

UNIT – II (12 Hrs)

Switching: Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Message-Switched Networks, Asynchronous Transfer Mode: Evolution, Benefits, Concepts,

Exploring Broadband Integrated Services Digital Network, Layer and Adaptation Layer, IPv4: Address Space, Notations, Classful, Classless, Network Address Translation, Datagram

Learning Outcomes: At the end of this unit, students should be able to

- Describe the switching process over networks. (L1)
- Explain data transmission process. (L1)
- Illustrate IPV4 addresses and classifications. (L3)

<u>UNIT – III</u> (10 Hrs)

Fragmentation and Checksum IPv6 Addresses: Structure, Address Space, Packet Format and Extension Headers, ICMP, IGMP, ARP, RARP, Congestion Control and Resource Allocation: Problem, Issues, Queuing, TCP Congestion Control, Congestion-Avoidance Mechanisms and Quality of Service

Learning Outcomes: At the end of this unit, students should be able to

- Perform fragmentations and error detection or correction approaches. (L3)
- Identify different network layer protocols. (L2)
- Estimate congestion occurrence and avoiding procedures. (L3)

<u>UNIT – IV</u> (8 Hrs)

Internetworking: Intra-Domain and Inter-Domain Routings, Unicast Routing Protocols: RIP, OSPF and BGP, Multicast Routing Protocols: DVMRP, PIM-DM, PIM-SM, CBT, MSDP and MOSPF, Spanning Tree Algorithm, Optical Networking: SONET/SDH Standards, Traffic Engineering: Requirement, Traffic Sizing, Characteristics, Protocols, Time and Delay Considerations, Connectivity, Availability, Reliability and Maintainability and Throughput.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze internetworking and routing process. (L4)
- Classify internetworking protocols. (L4)
- Illustrate optical networking and engineering functionalities. (L3)

<u>UNIT – V</u> (8 Hrs)

Multimedia Over Internet: Transmission, IP Multicasting and VoIP, Domain Name System: Name Space, Domain Name Space, Distribution, Domains, Resolutions and Dynamic Domain Name System, SNMP, Security: IPSec, SSL/TLS, PGP and Firewalls, Datacenter Design and Interconnection Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the multimedia transmission over internet. (L4)
- Illustrate domain name system. (L3)
- Apply security policies over interconnected networks. (L3)

TEXTBOOKS:

1. "Computer Networks: A System Approach", Larry L. Peterson and Bruce S. Davie, 5th Edition, Morgan Kaufmann, Elsevier, 2012.
2. "Data Communications and Networking", Behrouz A. Forouzan, McGraw Hill, 5th Edition, 2017.
3. "Introduction to Computer Networks and Cyber Security", Chwan-Hwa (John) Wu, J. David Irwin, CRC press, Taylor & Francis Group, 2014
4. "Computer Networks", Andrew S. Tanenbaum, David J. Wetherall, Pearson, 5th Edition, 2014.

REFERENCE BOOKS:

1. "Advanced Computer Networking: Concepts and Applications", Satish Jain

Course Code	OBJECT ORIENTED SOFTWARE ENGINEERING (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN02			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To learn and understand various O-O concepts along with their applicability contexts.
- To identify domain objects, their properties, and relationships among them.
- To identify and model/represent domain constraints on the objects and (or) on their relationships
- To learn various modelling techniques to model different perspectives of object-oriented software design (UML)

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the given project in various phases of a software lifecycle. **(K2)**

CO2: Analyze software requirements with use cases. **(K4)**

CO3: Examine the various design and development solutions with proper analysis. **(K3)**

CO4: Design and implement the Software projects. **(K3)**

CO5: Compare various testing methods. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Introduction to Software Engineering - Software Development process models – Agile Development - Project & Process - Project management - Process& Project metrics - Object Oriented concepts, Principles & Methodologies.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of software engineering. (L2)
- Illustrate the various development activities. (L2)

UNIT – II (10 Hrs)

Software Requirements Specification, Software prototyping - Software project planning - Scope - Resources - Software Estimation - Empirical Estimation Models – Planning - Risk Management - Software Project Scheduling - Object Oriented Estimation & Scheduling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand about software requirements specifications. (L2)

- Explain various software resources. (L5)

UNIT – III (11 Hrs)

Analysis Modelling - Data Modelling - Functional Modelling& Information Flow – Behavioural Modelling Structured Analysis - Object Oriented Analysis - Domain Analysis-Object oriented Analysis process - Object Relationship Model - Object Behaviour Model, Design modelling with UML

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various analysis concepts. (L5)
- Design modelling with UML. (L6)

UNIT – IV (10 Hrs)

Design Concepts & Principles - Design Process - Design Concepts - Modular Design - Design Effective Modularity - Introduction to Software Architecture - Data Design - Transform Mapping - Transaction Mapping - Object Oriented Design - System design process- Object design process - Design Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- List the basic design patterns. (L1)
- Describe the object oriented design and system design process. (L2)

UNIT – V (9 Hrs)

Top - Down, Bottom-Up, object oriented product Implementation & Integration. Software Testing methods White Box, Basis Path-Control Structure - Black Box - Unit Testing - Integration testing - Validation & System testing - Testing Tools – Software Maintenance & Reengineering

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate various software testing methods. (L2)
- Illustrate software maintenance and reengineering. (L3)

TEXTBOOKS:

1. "Software Engineering Concepts", Fairley R, 2nd edition, Tata McGraw Hill, New Delhi, 2003.
2. "An Integrated Approach to Software Engineering", Jalote P, 3rd edition, Narosa Publishers, New Delhi, 2013.

REFERENCE BOOKS:

1. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh, Ivar Jacobson, Addison Wesley, 1999.

2. "Object Oriented Systems Development", Ali Bahrami, 1st Edition, The McGraw-Hill Company, 1999

Course Code	SERVICE ORIENTED ARCHITECTURE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN03			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand SOA and evolution of SOA.
- To understand web services and primitive, contemporary SOA.
- To understand various service layers.
- To understand service-oriented analysis and design based on guidelines.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the characteristics and issues of SOA. **(K2)**
CO2: Classify and implement various message patterns of SOA. **(K3)**
CO3: Analyze various principles and services of SOA. **(K4)**
CO4: Implement a service using WSDL. **(K3)**
CO5: Design a SOA service for various Business Models. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Introducing SOA: Fundamental SOA, Common Characteristics of Contemporary SOA, Common Tangible Benefits of SOA, Common Pitfalls of Adopting SOA. The Evolution of SOA: An SOA Timeline, The Continuing Evolution of SOA, The Roots of SOA.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the fundamentals of SOA. (L1)
- Understand the advantages and disadvantages of SOA. (L2)

UNIT – II (11 Hrs)

Web Services and Primitive SOA: The Web Services Frame Work, Services, Service Descriptions, Messaging. Web Services and Contemporary SOA (Part I-Activity management and Composition): Message Exchange Patterns, Service Activity, Coordination, Atomic Transactions, Orchestration, and Choreography. Web Services and Contemporary SOA (Part-II-

Advanced Messaging, Metadata and Security): Addressing, Reliable Messaging, Correlation, Policies, Metadata exchange, Security.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various service primitive. (L2)
- Compare primitive and contemporary SOA. (L4)

UNIT – III (11 Hrs)

Principles of Service-Orientation: Service–Orientation and the Enterprise, Anatomy of SOA, Common Principles of Service–Orientation, Interrelation between Principles of Service-Orientation, Service Orientation and Object Orientation, Native Web Services Support for Principles of Service-Orientation. Service Layers: Service-Orientation and Contemporary SOA, Service Layer abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer, Agnostic Services, Service Layer Configuration Scenarios

Learning Outcomes: At the end of this unit, students should be able to

- Examine the Native Web services support for principles of SOA. (L3)
- Analyze various services in various layers of SOA. (L4)

UNIT – IV (12 Hrs)

SOA Delivery Strategies: SOA Delivery Lifecycle Phases, The Top-Down Strategy, The Bottom-up Strategy, The Agile Strategy. Service Oriented Analysis (Part I-Introduction): Introduction to Service Oriented Analysis, Benefits of a Business Centric SOA, Deriving Business Services. Service Oriented Analysis (Part-II-Service Modelling): Service Modelling, Service Modelling Guidelines, Classifying Service Model Logic, Contrasting Service Modelling Approaches. Service Oriented Design (Part I-Introduction): Introduction to Service-Oriented Design, WSDL Related XML Schema Language Basics, WSDL Language Basics, Service Interface Design Tools. Service Oriented Design (Part II-SOA Composition Guidelines): SOA Composing Steps, Considerations for Choosing Service Layers, Considerations for Positioning Core SOA Standards, Considerations for Choosing SOA Extensions.

Learning Outcomes: At the end of this unit, students should be able to

- Deploying a service using WSDL. (L3)

UNIT – V (10 Hrs)

Service Oriented Design (Part III- Service Design): Service Design Overview, Entity- Centric Business Service Design, Application Service Design, Task-Centric Business Service Design, Service Design Guidelines. Service Oriented Design (Part IV-Business Process Design): WS-BPEL Language Basics, WS- Coordination Overview, Service Oriented Business Process Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Web services Designs. (L2)
- Implement a SOA following the design guidelines. (L3)

TEXTBOOKS:

1. "Service-Oriented Architecture-Concepts, Technology and Design", Thomas Erl, Pearson Education, 2006.
2. "Understanding SOA with Web Services", Eric Newcomer, Greg Lomow, Pearson Education, 2005

REFERENCE BOOKS:

1. "Service Oriented Architecture Concepts Technology & Design", Thomas Erl, Pearson Education Limited; 2015, ISBN-13: 9788131714904.
2. "Service Oriented Architecture An Integration Blueprint", Guido Schmutz, Peter Welkenbach, Daniel Liebhart, Shroff Publishers & Distributors; 2010, ISBN-13: 9789350231081

Course Code	ADVANCED OPERATING SYSTEMS (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN04			**3**	**1**	**0**	**4**
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To be able to read and understand sample open source programs and header files.
- System calls which explore networking and security applications.
- To acquire the knowledge in the implementation of interprocess communication.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Realize the internals of Unix file system and analyze the functionalities of operating system. **(K3)**

CO2: Examine processes mechanism in operating system. Compare & contrast various system calls. **(K4)**

CO3: Understand the functionality of VFS. Analyze various file system types. **(K4)**

CO4: Realize the internals of windows operating system. Analyze the functionalities of windows operating systems. **(K4)**

CO5: Build mobile applications using Android. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Basic Operating System Concepts - Overview of Unix File System - Files - Links - Types – Inodes -Access Rights - System Calls - Overview of Unix Kernels -Model - Implementation - Reentrant Kernels - Address Space - Synchronization - Interprocess Communication - Process Management - Memory Management - Device Drivers.

Learning Outcomes: At the end of this unit, students should be able to

- Define functionalities of Unix file system. (L1)
- Categorize different kinds of system calls. (L4)

UNIT – II (10 Hrs)

Processes, Lightweight Processes, and Threads - Process Descriptor - State - Identifying a Process - Relationships among processes - Organization - Resource Limits - Creating Processes - System Calls - Kernel Threads - Destroying Processes -Termination - Removal.

Learning Outcomes: At the end of this unit, students should be able to

- Identify various states in process life cycle. (L2)
- Differentiate processes, system calls, kernel threads. (L4)

UNIT – III (10 Hrs)

The Virtual File System (VFS) - Role - File Model -System Calls - Data Structures - Super Block, Inode, File, dentry Objects - dentry Cache - Files Associated with a Process - Filesystem Types - Special Files systems – Filesystem Type Registration – Filesystem Handling - Namespaces - Mounting – Unmounting - Implementation of VFS System Calls

Learning Outcomes: At the end of this unit, students should be able to

- Implement VFS system calls. (L3)
- Distinguish file system types and special file systems. (L3)
- Define functionalities of VFS. (L1)

UNIT – IV (10 Hrs)

Windows Operating system - versions, Concepts and tools, Windows internals, System Architecture, Requirements and design goals, Operating system model, Architecture overview. Key system components. System mechanisms - Trap dispatching, object manager, Synchronization, System worker threads, Windows global flags, Local procedural calls, Kernel event tracing.

Learning Outcomes: At the end of this unit, students should be able to

- Define functionalities of windows operating system. (L1)
- Differentiate various system mechanisms. (L4)

UNIT – V (10 Hrs)

What is android, basic building blocks – activities, services, broadcast receivers & content, ui components views & notifications, components for communication -intents & intent filters, android api levels launching emulator editing emulator settings emulator shortcuts log cat usage, Applications of Android

Learning Outcomes: At the end of this unit, students should be able to

- Develop various applications using Android. (L6)
- Identify building blocks of Android. (L2)

TEXTBOOKS:

1. "Understanding the Linux Kernel", Daniel P. Bovet and Marco Cesati, 3rd Edition, O'Reilly Publications, 2005.
2. “Structure and Interpretation of Computer Programs”, Harold Abelson, Gerald Jay Sussman and Julie Sussman, 2nd Edition, Universities Press, 2013.

REFERENCE BOOKS:

1. "Microsoft Windows Internals", Mark E. Russinovich and David A. Solomon, 4th Edition, Microsoft Press, 2004

CSE-INTERNET OF THINGS

(For the batches admitted from the academic year 2021-22)

Vision

- To be a recognized Centre in the field of Computer Science and Engineering by imparting quality education and also equipping the students with latest technologies, soft skills and ethical values to face the challenges in industry & society.

Mission

- To provide quality education by imparting state of the art facility in Computer Science and Engineering.
- Enrich the students with innovative and problem-solving skills by establishing continuous Industry Institute interaction.
- To prepare the learners possessing social commitment and ethical values to face the dynamic challenges of industry and society.

Institutional Objectives

- To create a conducive and competitive environment for students through curricular and extra-curricular activities.
- Promote the culture of research among the faculty.
- To promote synergetic alliances with premier Institutions, Industry, CSIR laboratories and various Government organizations for Collaborative Research Projects.
- To promote economic and social enrichment of the society through Skill Development programmes, Entrepreneurship and extension activities.
- To introduce demand-driven new UG&PG academic programmes.
- To ensure a high degree of quality in terms of providing infrastructure, research ambience, faculty and staff development.

Core Values

- *Thirst for Quality Education:* The stake holders of the institute particularly management, employees and students of the institution have a consistent thirst for quality improvement of the processes and services in the institution.
- *Lifelong Learning:* In the fast-changing technological world, acquiring a special skill at one point of time will not be enough for ever long survival. Hence to flourish in the work place and to bring in innovations in the ways of doing, employee, student as well as alumni must be continuous learners and tech savvy.

- *Diversity and Participation:* PBRVITS promotes the involvement of faculty, staff and students from all social, economic, ethnics, cultural and religious backgrounds to get the synergy of combining the diversified agents. The focus is on involving students to exhibit their talent in various curricular and co-curricular activities and strengthening alumni link to share their experiences to the students.
- *Academic Integrity and Accountability:* Management induces accountability in the employees for the career of the students and the academic leadership establishes a mentoring mechanism for realization of responsibilities of students towards their parents and in turn to the society.

CSE - INTERNET OF THINGS

(For the batches admitted from the academic year 2021-22)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept./Branch & Innovations

Semester I (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110101	Calculus and Special Functions	3	0	0	3	30	70	100
2	BS	21A110105	Applied Chemistry	3	0	0	3	30	70	100
3	ES	21A050302	C-Programming & Data Structures	3	0	0	3	30	70	100
4	BS	21A110106	Engineering Physics	3	0	0	3	30	70	100
5	HSMC	21A110202	English for Professionals	2	0	0	2	30	70	100
6	ES	21A050301	Engineering & IT Workshop	0	0	3	1.5	30	70	100
7	BS	21A110109A	Engineering Physics Lab	0	0	3	1.5	30	70	100
8	BS	21A110108B	Applied Chemistry Lab	0	0	3	1.5	30	70	100
9	ES	21A050303	C-Programming & Data Structures Lab	0	0	3	1.5	30	70	100
Total							**20**			**900**

Semester II (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110102	Mathematical Methods	3	0	0	3	30	70	100
2	BS	21A110110	Probability and Statistics	3	0	0	3	30	70	100
3	ES	21A030301	Engineering Drawing	1	0	4	3	30	70	100
4	ES	21A050304	Advanced Data Structures through C++	3	0	0	3	30	70	100
5	ES	21A020303	Basic Electrical and Electronics Engineering	3	0	0	3	30	70	100
6	HSMC	21A110201	Communicative English Lab	0	0	2	1	30	70	100
7	ES	21A020304	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
8	ES	21A050305	Advanced Data Structures through C++ Lab	0	0	3	1.5	30	70	100
9	MC	21A000001	Environmental Science	2	0	0	0	30	--	--
Total							**19**			**800**

Semester III (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110111	Mathematical Foundations of Computer Science	3	0	0	3	30	70	100
2	PC	21A050401	Digital Logic Design & Computer Organization	3	0	0	3	30	70	100
3	PC	21A050402	Database Management Systems	3	0	0	3	30	70	100
4	PC	21A050403	Object Oriented Programming through Java	3	0	0	3	30	70	100
5	ES	21A350301	Fundamentals of Data Communications	3	0	0	3	30	70	100
6	PC	21A050404	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC	21A050405	Object Oriented Programming through Java Lab	0	0	3	1.5	30	70	100
8	ES	21A350302	Communication Systems Lab	0	0	3	1.5	30	70	100
9	SC	21A050702	Graphics Design using Photoshop	1	0	2	2	30	70	100
10	MC	21A000002	Constitution of India	2	0	0	0	30	--	--
Total							**21.5**			**900**

Semester IV (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050406	Internet of Things	3	0	0	3	30	70	100
2	PC	21A050407	Software Engineering & OOAD	3	0	0	3	30	70	100
3	ES	21A050306	Python Programming & Data Science	3	0	0	3	30	70	100
4	ES	21A050309	Micro Processors & Micro Controllers	2	0	2	3	30	70	100
5	HSMC	21A110203	Managerial Economics and Financial Analysis	3	0	0	3	30	70	100
6	PC	21A050410	Internet of Things Lab	0	0	3	1.5	30	70	100
7	PC	21A050411	Software Engineering & OOAD Lab	0	0	3	1.5	30	70	100
8	ES	21A050307	Python Programming & Data Science Lab	0	0	3	1.5	30	70	100
9	SC	21A050703	Advanced Java	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship-I (Community Service Project) during semester break										

Semester V (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050409	Operating Systems	3	0	0	3	30	70	100
2	PC	21A050414	Software Testing	3	0	0	3	30	70	100
3	PC	21A050408	Computer Networks	3	0	0	3	30	70	100
4	OE-I		**Open Elective – I**	3	0	0	3	30	70	100
5	PE-I	21A350401 21A050417 21A050418	**Professional Elective – I** a) Sensors and Internet of Things b) SAP c) Mobile Computing	3	0	0	3	30	70	100
6	PC	21A050419	Software Testing Lab	0	0	3	1.5	30	70	100
7	PC	21A050412	Computer Networks & Operating Systems Lab	0	0	3	1.5	30	70	100
8	SC	21A350701	Programming in Embedded C	1	0	2	2	30	70	100
9	MC	21A000003	Universal Human Values	3	0	0	3	30	70	100
10	PROJ	21A350601	Internship – I Evaluation	-	-	-	1.5	-	-	100
Total							**24.5**			**1000**

Semester VI (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050421	Artificial Intelligence	3	0	0	3	30	70	100
2	PC	21A050422	Mobile Application Development	3	0	0	3	30	70	100
3	PC	21A350402	Cyber Physical Systems	3	0	0	3	30	70	100
4	PE-II	21A350403 21A310413 21A350404	**Professional Elective -II** a) Wireless & Adhoc Networks b) Real Time Systems c) Embedded Systems for IOT	3	0	0	3	30	70	100
5	OE-II		**Open Elective - II**	3	0	0	3	30	70	100
6	PC	21A050427	Mobile Application Development Lab	0	0	3	1.5	30	70	100
7	PC	21A050428	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
8	PC	21A350405	Cyber Physical Systems Lab	0	0	3	1.5	30	70	100
9	SC	21A350702	Arduino Programming	1	0	2	2	30	70	100
10	MC	21A000004	Research Methodology	2	0	0	0	30	---	---
Total							**21.5**			**900**
Internship-II (Industry) during semester break										

Semester VII (Fourth year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PE-III	21A350406 21A050431 21A050432	**Professional Elective -III** a) 5G Technology b) Big-Data Analytics using Hadoop c) Deep Learning	3	0	0	3	30	70	100
2	PE-IV	21A350407 21A050435 21A350408	**Professional Elective-IV** a) Computer Vision with OpenCV b) Design Patterns c) Natural Language Processing	3	0	0	3	30	70	100
3	PE-V	21A050433 21A350409 21A350410	**Professional Elective -V** a) Cyber Security b) Digital Forensics c) IOT & Multimedia Systems	3	0	0	3	30	70	100
4	OE-III		**Open Elective - III**	3	0	0	3	30	70	100
5	OE-IV		**Open Elective - IV**	3	0	0	3	30	70	100
6	HSMC	21A110204	Management Science	3	0	0	3	30	70	100
7	SC	21A050706	Hacking Tools	1	0	2	2	30	70	100
8	PROJ	21A350602	Internship-II Evaluation	-	-	-	3	--	--	100
Total							**23**			**800**

Semester VIII (Fourth Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PROJ	21A350603	Full Internship & Major Project	-	-	12	10	110	140	250
2	PROJ	21A350604	Technical Seminar	-	-	4	2	50	-	50
Total							**12**			**300**

Open Elective – I

S. No	Course Code	Course Title
1	21A010501	Air Pollution and Control
2	21A020501	Electric Vehicles
3	21A020502	Electrical Distribution Systems
4	21A030501	Robotics
5	21A030502	Basics of Mechanical Engineering
6	21A040501	Integrated Circuits and Applications
7	21A040502	Introduction to Signal Processing

Open Elective – II

S. No	Course Code	Course Title
1	21A010502	Environmental Pollution and Control
2	21A020503	Smart Grid
3	21A020504	Energy Storage Systems
4	21A030503	Automation in Industries
5	21A030504	Rapid Prototyping
6	21A040503	Principles of Communication Systems
7	21A040504	Electronic Instrumentation

Open Elective – III

S. No	Course Code	Course Title
1	21A010503	Disaster Management and Mitigation
2	21A020505	Renewable Energy Systems
3	21A020506	Concepts of Electrical Drives and Applications
4	21A030505	Optimization Techniques
5	21A030506	Global Warming and Climate Changes
6	21A040505	Electronic Sensors
7	21A040506	Introduction to Image Processing

Open Elective – IV

S. No	Course Code	Course Title
1	21A010504	Cost Effective Housing Techniques
2	21A020507	Energy Conservation and Management
3	21A020508	Basics of Power Electronics
4	21A030507	Basics of Automotive Engineering
5	21A030508	Basics of Total Quality Management
6	21A040507	Principles of Cellular and Mobile Communications
7	21A040508	Embedded Systems

COURSES OFFERED FOR HONOURS DEGREE IN CSE-IOT

S. No	Course Code	Course Title	Hours per week		Credits	CIE	SEE	Total
			L	T	C			
1	21A05HN01	Advanced Computer Networks	3	1	4	30	70	100
2	21A05HN02	Object Oriented Software Engineering	3	1	4	30	70	100
3	21A05HN03	Service Oriented Architecture	3	1	4	30	70	100
4	21A05HN04	Advanced Operating Systems	3	1	4	30	70	100
5	21A05HN05	MOOC – 1	-	-	2	-	-	-
6	21A05HN06	MOOC – 2	-	-	2	-	-	-

LIST OF MINORS OFFERED TO CSE-IOT

S. No	Course Code	Course Title	Department offering the course
1	21A040402	Pulse and Digital Circuits	ECE
2	21A040415	Data Communication and Networking	ECE
3	21A040433	Biomedical Signal Processing	ECE
4	21A040434	Radar Engineering	ECE

Course Code	CALCULUS AND SPECIAL FUNCTIONS (Common to all branches)		L	T	P	C
21A110101			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course will illuminate the students in the concepts of calculus and Mean value theorems.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Utilize mean value theorems to real life problems.

CO2: Familiarize with functions of several variables which is useful in optimization.

CO3: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems.

CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 3- dimensional coordinate systems.

CO5: Utilize special functions in evaluating definite integrals.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (10 Hrs)

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT – II (12 Hrs)

Multi variable calculus: Partial derivatives, total derivatives, chain rule, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes: At the end of this unit, students should be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

UNIT – III (10 Hrs)

Double Integrals: Evaluation of Double integrals, change of order of integration, change of variables. Areas using Double Integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

UNIT – IV (10 Hrs)

Triple Integrals: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volumes using triple integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate triple integrals in Cartesian, cylindrical and spherical polar coordinates. (L5)
- Apply triple integration techniques in evaluating volumes. (L4)

UNIT – V (12 Hrs)

Beta and Gamma functions: Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

TEXTBOOKS:

1. "Higher Engineering Mathematics", S. Grewal, Khanna Publishers, 44/e, 2017.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.

2. "Calculus", George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
3. "Advanced Modern Engineering Mathematics", Glyn James, Pearson publishers, 4/e, 2011.
4. "Advanced Engineering Mathematics", Michael Greenberg, Pearson Education, 9th Edition.
5. "Advanced Engineering Mathematics with MATLAB", Dean G. Duffy, CRC Press
6. "Advanced Engineering Mathematics", Peter O'Neil, Cengage Learning.
7. "Engineering Mathematics Volumes-I &II", R.L. Garg Nishu Gupta, Pearson Education
8. "Higher Engineering Mathematics", B. V. Ramana, McGraw Hill Education
9. "Higher Engineering Mathematics", H. K. Das, Er. Rajnish Verma, S. Chand & Co. Ltd.
10. "Advanced Engineering Mathematics", N. Bali, M. Goyal, C. Watkins, Infinity Science Press.
11. "Engineering Mathematics", T.K.V Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications.

Course Code	APPLIED CHEMISTRY (Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110105			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To familiarize Applied chemistry and applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods and applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the salient features of different theories along with their applications.
CO2: Discuss about the model engineering materials.
CO3: Apply the knowledge of various electrodes for the development of new batteries.
CO4: Identify the different polymers and their uses in various fields of engineering.
CO5: Analyze the knowledge of different analytical techniques used in engineering and also development of new techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	-

UNIT-I (14 Hrs)

Structure and Bonding Models: Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, Molecular orbital theory –bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, π-molecular orbital's of butadiene and benzene, calculation of bond order. Crystal field theory–salient features–splitting in octahedral and tetrahedral geometry.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Discuss the basic concept of molecular orbital theory (L3)
- Explain the calculation of bond order of O_2 and CO molecules (L2)
- Discuss the salient features of Crystal field theory (L3)

UNIT-II (10 Hrs)

Modern Engineering Materials: Band theory of solids- band diagrams for conductors, Insulators, Semiconductors, Effect of doping on band structures. Super conductors and Super capacitors: Introduction, Definition, Classification, Applications.

Nano chemistry: Introduction, classification of nano materials, properties and applications of Fullerenes, carbon nanotubes and Graphene nanoparticles.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nanotubes and Graphenes nanoparticles (L2).

UNIT-III (13 Hrs)

Electro Chemistry and Applications: Electrodes and their concepts, Types of Reference electrodes-their applications. Electrochemical cell, Nernst equation, Numerical problems on emf.

Primary cells – Zinc-air battery, Secondary cells – Lead-acid and Lithium-ion batteries-working of the batteries including cell reactions; Fuel cells- hydrogen-oxygen, methanol- oxygen fuel cells – working of the cells.

Potentiometry- principle, potentiometric titrations (redox titrations), Conductometry-conductometric titrations (acid-base titrations).

Electrochemical sensors– potentiometric sensors principle with examples, ampere metric sensors principle with examples and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)

UNIT-IV (13 Hrs)

Polymer Chemistry: Introduction to polymers, functionality of monomers and their significance, Tacticity of polymers, Types of polymerization- chain growth, step growth and copolymerization with specific examples and mechanisms of polymer formation.

Plastomers-Thermoplastics and Thermo setting plastics, Preparation, properties and applications of– PVC, Teflon, Bakelite, Nylons.

Elastomers – Buna-S, Buna-N– preparation, properties and applications of Buna-S, Buna-N.

Conducting polymers, examples, classification, polyacetylene, polyaniline - mechanism of conduction and applications.

Learning Outcomes*:* At the end of this unit, students should be able to

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylons (L2)
- Describe the mechanism of conduction in conducting polymers (L2)

- Discuss Buna-S and Buna-N and their applications (L2)

UNIT-V (10 Hrs)
Instrumental Methods and Applications: Introduction, Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law- Principle, instrumentation and applications of UV-Visible**,** IR-Spectroscopy's and pH-metry, Solid-Liquid Chromatography–TLC, retention factor.
Learning Outcomes*:* At the end of this unit, students should be able to
- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles and applications of different analytical instruments (L2)

TEXTBOOKS:
1. "Engineering Chemistry", Jain and Jain, Dhanpat Rai publications, 17/e, 2018
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014
3. "Principles of Instrumental Analysis", Skoog, FJ Holler and SR Crouch, 7/e, 2018
4. "Applied Chemistry", Guesser, Springer's Publications, 2001
5. "Atkins' Physical Chemistry", Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 10/e, 2010

REFERENCE BOOKS:
1. "Concise Inorganic Chemistry", J. D. Lee, Oxford University Press, 5/e, 2008
2. "Engineering Chemistry", G. V. Subba Reddy, K. N. Jayaveera and Ramachandraiah, McGraw Hill, 2020.

Course Code	C-PROGRAMMING & DATA STRUCTURES (Common to all branches)		L	T	P	C
21A050302			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- Demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C using Arrays and Strings.
CO3: Modularize the problem and also solution.
CO4: Design applications in C using Functions, Pointers, and Structures.
CO5: Explore various operations on Stacks, Queues and Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Computer Fundamentals, Algorithm, Flowchart.

Introduction to C Language: Characteristics, Identifiers, Constants, Data types, Keywords, Basic input/output statements, Structure of a C program.

Operators and Expressions: Operators classification, Assignment Operator, Arithmetic Operators, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators with examples – Operator precedence and Associativity, Type casting.

Statements: Simple and Compound statements, Control Statements - Conditional/Decision statements, Loop Control Statements, Branch Control statements.

Learning Outcomes: At the end of this unit, students should be able to

- Solve complex problems using language independent notations (L3)
- Use C basic concepts to write simple C programs (L3)

- Test and execute the programs and correct syntax and logical errors (L4)
- Select the control structure for solving the problem (L4)
- Implement conditional branching, iterations (L2)

UNIT-II (12 Hrs)

Arrays: Declarations, Initialization and accessing elements, Single, Two and Multi-dimensional arrays.

Array Techniques: Array order reversal, finding the maximum and minimum number in a set, sorting the given array elements.

Strings: String I/O functions, String handling functions, Data conversion functions.

Learning Outcomes: At the end of this unit, students should be able to

- Use arrays to process multiple homogeneous data (L3)
- Solve mathematical problems using C Programming languages (L3)
- Apply string handling functions (L3)

UNIT-III (12 Hrs)

Functions: Types of functions, Library functions, User-defined functions, Function Categories, Nested functions, Recursion, Symbolic constants, Pre-processor Commands, Storage classes – auto, register, static, extern, Type qualifiers.

Input and output: Standard input and output, Non-formatted Input and Output statements, Formatted Input and Output statements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of modular programming (L2)
- Apply modular approach for solving the problem (L3)
- Writing C programs using various storage classes to control variable access (L5)
- Apply input and output statements to process the data in various formats (L3)

UNIT-IV (12 Hrs)

Pointers: Pointers and addresses, Passing parameters to functions, Address Arithmetic operations, Void and Null pointers, Pointer and Arrays, Pointer and Strings, Array of Pointers, Pointer and Functions, Pointer-to-Pointer, Dynamic Memory Allocation. Uses of Pointers, Command line Arguments.

Structure and Union: Declaration and Initialization of a structure, Copy and comparisons, Array of structures, Structure with pointer, Nested structures, Type Definition, Enumeration, Union.

Learning Outcomes: At the end of this unit, students should be able to

- Structure the individual data elements to simplify the solutions (L6)
- Facilitate efficient memory utilization (L6)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT-V (14 Hrs)

Data Structures: Overview of data structures, **Stack:** Representation of a stack, Operations and Applications of a Stack – Evaluation of Arithmetic Expressions, Implementation of Recursion – **Queue:** Representation of a queue, Operations and Applications of a Queue – CPU Scheduling in Multi-programming Environment.

Linked List: Representations of linked lists, singly linked list, doubly linked list, Circular linked list and its operations.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the operations of a stack (L2)
- Develop various operations on Queues (L6)
- Analyze various operations on singly linked list (L4)
- Interpret operations of doubly linked lists (L2)
- Apply various operations on Circular linked lists (L6)

TEXTBOOKS:

1. "The Complete Reference C", Herbert Schildt, McGraw Hill Education, Fourth Edition
2. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
3. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition
2. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

Course Code	ENGINEERING PHYSICS (Common to CE, ME, CSE-IOT, CSE-AI, AIML)		L	T	P	C
21A110106			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To present the basic concepts needed to understand the crystal structure of materials, X- ray diffraction and the importance of nano materials.
- To understand the mechanisms of lasers and propagation of light through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To explain the significance of acoustics and ultrasound in different engineering fields.
- Evolution of band theory to distinguish materials and explain the properties of semiconductors.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Explain the important properties of crystals & structure determination using X-ray Diffraction along with the nano materials.

CO2: Identify the importance of lasers and fiber optics in different engineering fields

CO3: Understands the response of dielectric & magnetic materials to the applied electric & magnetic fields

CO4: Explain the basic concepts of acoustics and ultrasonics.

CO5: Elaborate the physical properties of semiconductors.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Crystallography & Nano materials

Crystallography: Introduction – Space lattice – Unit cell – Lattice parameters – Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Laue Method - Powder method.

Nano materials – Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Classify various crystal systems (L2)
- Identify different planes in the crystal structure (L3)
- Analyze the crystalline structure by Bragg's law to measure the crystallinity of a solid by powder method (L4)
- Identify the nano size dependent properties of nano materials (L2)
- Illustrate the methods for the synthesis and characterization of nano materials (L2)

UNIT - II (12 Hrs)

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Transmission of signals in step index and graded index fibers – Propagation Losses (qualitative) – Applications of fiber in medical field .

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

UNIT – III (12 Hrs)

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius - Mosotti relation in dielectrics (L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence

(L2)
- Explain the applications of dielectric and magnetic materials (L2)

UNIT - IV (13 Hrs)

Acoustics and Ultrasonics

Acoustics- Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine's formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

Ultrasonics- Introduction – Properties – Production by magneto striction and piezoelectric methods – Detection – Acoustic grating – Non Destructive Testing – Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain how sound is propagated in buildings (L2)
- Analyze acoustic properties of typically used materials in buildings (L4)
- Recognize sound level disruptors and their use in architectural acoustics (L2)
- Identify the use of ultrasonics in different fields (L3)

UNIT - V (13 Hrs)

Semiconductors- Origin of energy bands - Classification of solids into conductors, semiconductors and insulators -Intrinsic and extrinsic semiconductors (Qualitative treatment)– Density of carriers and Fermi levels in intrinsic & extrinsic semiconductors Drift & diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)

TEXTBOOKS:

1. "Engineering Physics", Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, S. Chand and Company
2. "Engineering Physics", B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. "Engineering Physics", K. Thyagarajan, McGraw Hill Publishers

REFERENCE BOOKS:

1. "Engineering Physics", Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. "Engineering Physics", Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
3. "Semiconductor physics and devices - Basic principles", Donald A, Neamen, McGraw

Hill
4. "Engineering physics", P.K. Palanisamy, SCITECH Publications
5. "Applied Physics", S. Mani Naidu, Pearson Publications
6. "Lasers and Non-Linear Optics", B.B Laud, New Age International Publishers.

Course Code	ENGLISH FOR PROFESSIONALS		L	T	P	C
21A110202	(Common to all branches)		2	0	0	2
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To improve Reading and Writing proficiency of students in English with an emphasis on Vocabulary development.
- To provide knowledge of grammatical structures and encourage their appropriate use in writing.
- To improve students' comprehension skills required for academic and professional needs.
- To equip students with writing skills required for professional correspondence in different contexts.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate word knowledge and its usage in appropriate contexts.
CO2: Recognize and incorporate basic grammar mechanics and sentence variety in writing.
CO3: Improve comprehension skills through intensive and extensive reading practice.
CO4: Learn and apply various writing formats for effective communication.
CO5: Improve writing skills needed for professional correspondence in various contexts.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

UNIT-I (10 Hrs)

Vocabulary Building: Introduction to affixes and base words, Prefixes and suffixes, Basic comparing and contrasting, Idioms and Phrases, One word substitutes, Words often confused, Synonyms and Antonyms used in the everyday contexts, Using prior knowledge to determine the correct word for the context, Discovering the correct word in the sentence by looking at the surrounding words, Vocabulary in social interactions.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize word parts: affixes, prefixes, suffixes and base words. (L2)
- Use words appropriately in a context. (L3)
- Guess the meanings of the words by using the contextual clues. (L2)
- Use synonyms, antonyms, phrases and idioms in writing. (L2)

UNIT-II **(10 Hrs)**

Essentials of Sentence Formation: Basic Sentence Structure, word order, Subject-Verb Concord, Using Tenses, Punctuation Marks, Correction of Common Errors

Learning Outcomes: At the end of this unit, students should be able to

- Frame a sentence without any grammatical errors. (L3)
- Use appropriate punctuation marks. (L3)
- Identify common errors in a sentence. (L2)

UNIT-III **(10 Hrs)**

Reading Comprehension: Understanding short real-world notices, messages, factual material - Scanning, skimming - Inferring meaning - Critical reading - Reading and information transfer

Learning Outcomes: At the end of this unit, students should be able to

- Use skimming and scanning strategies while reading. (L3)
- Infer meaning from the given text. (L3)
- Distinguish between the main idea and supporting ideas. (L3)
- Critically analyse the given text. (L4)

UNIT-IV **(10 Hrs)**

Writing Skills: Rules for good writing and composition; Paragraph Writing: Structure of a paragraph, Types of paragraphs, Usage of Cohesive Devices; Essay writing: Structure of an Essay, Types of Essays; Letter Writing (Formal and informal): Format and Structure; and Email writing

Learning Outcomes: At the end of this unit, students should be able to

- Learn to organize thoughts into meaningful paragraphs. (L2)
- Use cohesive devices in making the piece of writing more coherent. (L3)
- Compose essays on different topics in a more organised structure. (L3)
- Draft letter and emails in a definite format. (L3)

UNIT-V **(10 Hrs)**

Professional Correspondence: Internal Correspondences – Memorandum, Note Taking, Minutes of Meetings; External Correspondences - Business Letters - Cover Letters - Sale Letters - Inquiry Letters - Complaint Letters - Emails & Netiquette

Learning Outcomes: At the end of this unit, students should be able to

- Draft official e-mails and letters for different professional purposes. (L3)
- Write proficiently memos and minutes of meeting. (L3)

TEXTBOOKS:

1. “Technical Communication – Principles and Practice”, Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://digital.library.upenn.edu/women/sultana/dream/dream.html
2. https://owl.purdue.edu/
3. https://www.thesaurus.com/
4. https://www.readwritethink.org/classroom-resources/student-interactives
5. https://www.fluentu.com/blog/english/english-writing-websites/

Course Code	**ENGINEERING & IT WORKSHOP LAB**		**L**	**T**	**P**	**C**
21A050301	(Common to all branches)		**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	I			

PART-A (ENGINEERING WORKSHOP)

COURSE OBJECTIVES:

- To familiarize the students with wood working, sheet metal operations, fitting and electrical house, Wiring and foundry skills.
- To provide technical training to the students on Word, Excel and Presentation.
- To make the students know about the internal parts of a computer.
- To learn how to use Internet facility for Browsing and Searching.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply wood working skills and build different parts with metal sheets in real world applications.
CO2: Apply fitting operations in various applications and Preparation of moulds and castings.
CO3: Apply different types of basic electric circuit connections.
CO4: Prepare documentation, spread sheets for calculations and slides for Presentation.
CO5: Identify Computer peripherals and its functions, Internet browsing to obtain the required information

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	1	-
CO2	3	2	2	-	-	2	-	-	-	-	-	2	1	-
CO3	3	2	-	-	-	2	-	-	-	-	-	2	1	2
CO4	3	-	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

LIST OF TOPICS:

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints
a) Half – Lap joint b) Dovetail joint or Bridle joint
Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets
a) Tapered tray b) Conical funnel
Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises
a) V-fit b) Square fit.

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting

Foundry:

a) Preparation of mould cavity using single piece pattern.
b) Preparation of mould cavity using split piece pattern

PART-B (IT WORKSHOP)

LIST OF TOPICS:

Task 1:

MS-Word: Students should be able to create documents using the word processor tool. Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit report.

Task 2:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 3:

Presentations: creating, opening, saving the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, running the slide show.

Task 4: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 5:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.

REFERENCE BOOKS:

1. "Workshop Practice Manual", K. Venkata Reddy, BS Publications.
2. "Engineering work shop practice for JNTU", V. Ramesh babu, VRB Publishers Pvt. Ltd., 2009.
3. "Work shop manual", P. Kannaiah, K. L. Narayana, SCITECH Publishers.
4. "Engineering practices lab manual", Jeyapoovan, Saravanapandian, Vikas Publishing House, 4/E
5. "Dictionary of mechanical engineering", GHF Nayler, Jaico Publishing House.
6. "Introduction to Computers", Peter Norton, McGraw Hill
7. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox.
8. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
9. "Networking your computers and devices", Rusen, Prentice Hall of India
10. "Bigelow's Trouble shooting, Maintaining & Repairing PCs", Bigelow, Tata McGraw Hill Edition

Course Code	ENGINEERING PHYSICS LAB		L	T	P	C
21A110109A	(Common to CE, ME, CSE-IOT, CSE-AI, AIML)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its application in finding the wavelength.
- Understands the concepts of interference, diffraction and their applications.
- Verify the Laws of Stretched Strings by sonometer.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Operate various optical instruments

CO2: Estimate wavelength of laser using laser

CO3: Evaluate the acceptance angle of an optical fiber and numerical aperture

CO4: Plot the intensity of the magnetic field of circular coil carrying current with distance

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	-

LIST OF EXPERIMENTS

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of wavelength of LASER light using diffraction grating.
5. Determination of numerical aperture and acceptance angle of a given optical fiber
6. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
7. Sonometer: Verification of the three laws of stretched strings
8. Determination of particle size using LASER.
9. Study the variation of B versus H by magnetizing the magnetic material. (B-H curve)
10. Determination of rigidity modulus of material of a wire -dynamic method. (Torsional Pendulum)

REFERENCE BOOKS:

1. "A Textbook of Practical Physics", S. Balasubramanian, M.N. Srinivasan, S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Code	APPLIED CHEMISTRY LAB		L	T	P	C
21A110108B	(Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of Chemistry
- To verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Distinguish different types of titrations in the volumetric analysis

CO2: Determine the cell constant and conductance of solutions

CO3: Measure the strength of an acid present in secondary batteries

CO4: Analyze the effect of absorbance of given sample solution on concentration by using colorimetry.

CO5: Prepare advanced polymer Bakelite materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-		-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Preparation of Standard Oxalic acid solution
2. Determination of Strength of an acid in Lead- Acid battery
3. Estimation of Ferrous Iron by Dichrometry
4. Potentiometry - Determination of redox potentials and emfs
5. Conductometry - Determination of cell constant and conductance of solutions.
6. Conductometric titration of a) strong acid vs strong base b) weak acid vs strong base.
7. P^H-metric titration of a) strong acid vs strong base b) weak acid vs strong base.
8. Verification of the Beer-Lambert's Law and determination of strength of the given unknown solution.
9. Determination of the Retention factor of the sample by Thin Layer Chromatography (TLC).
10. Measurement of 10Dq by spectrophotometric method.
11. Preparation of Bakelite and measurement of its mechanical properties (strength)
12. Preparation of nanomaterials.

TEXTBOOKS:

1. "A Text Book on Experiments and Calculations in Engineering Chemistry", S. Chand Publications, 9/e, 2003.
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014.
3. "Experiments in Applied Chemistry", Dr. Sunita Rattan, S. K. Kataria & Sons Publishers of Engineering, 2/e, 2004.

REFERENCE BOOKS:

1. "Vogel's Text Book of Quantitative Chemical Analysis", Mendham J et.al, Pearson Education, 6/e, 2012.

Course Code	C-PROGRAMMING & DATA STRUCTURES LAB (Common to all branches)		L	T	P	C
21A050303			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of C Programming
- To make the student solve problems, implement algorithms using C language
- To design programs using arrays, strings, pointers and structures
- To design Stack and Queue operations
- To apply different operations on linked lists

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the basic concepts of C programming language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs using functions, arrays, structures and pointers.
CO4: Illustrate the concepts Stacks and Queues.
CO5: Design operations on Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

Week 1

a) Write a C program to swap the given two integer values without using temporary variable.
b) Write a C program to print the first 'N' Fibonacci sequence numbers.

Week 2

a) Write a C program to print reverse of a given integer value.
b) Write a C program to find the roots of a quadratic equation.

Week 3

Write a C program that use recursive functions.

i) GCD of given two values.
ii) Factorial of a given value.

Week 4

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program to perform the following:

i) Addition of Two matrices ii) Multiplication of Two matrices

Week 5

a) Write a C program that displays the position or index in the string S where the string T begins or -1 if S doesn't contain T.

b) Write a C program to read a set of strings and sort them in alphabetical order.

Week 6

a) Write a C program to count number of alphabets, digits and special symbols of a given line.

b) Write a C program to check whether a given string is palindrome or not.

Week 7

Write a C program to demonstrate the difference between call-by-value and call-by-address mechanisms.

Week 8

Write a program to perform the operations addition, subtraction, multiplication of complex numbers.

Week 9

Write a C program that implement stack operations using arrays.

Week 10

a) Write a C program that implement linear queue operations using arrays.

b) Write a C program that implement circular queue operations using arrays.

Week 11

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on doubly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following operations on circular linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

TEXTBOOKS:

1. “Programming in C and Data Structures”, J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
2. “Computer Science: A Structured Programming Approach Using C”, B.A. Forouzon and R.F. Gilberg, CENGAGE Learning, Third Edition, 2016.
3. “C and Data Structures”, E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
4. “Schaum’s Outline of Data Structures”, Seymour Lipschutz, McGraw Hill, Revised First Edition.

REFERENCE BOOKS:

1. “The C Programming Language”, Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition,
2. “Fundamentals of Data Structures in C”, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition.
3. “Programming in C”, Pradip Dey and Manas Ghosh, Oxford University Press, 2018.

Course Code	MATHEMATICAL METHODS (Common to all branches)		L	T	P	C
21A110102			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- This course aims at providing use of matrix algebra techniques for practical applications.
- This course aims at providing the student with the knowledge on Various numerical Methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop the use of matrix algebra techniques that is needed by engineers for practical applications.

CO2: Understand and solve the roots of equation using Bisection method, Iterative method, Regula-Falsi method, Newton Raphson method and solve the system of algebraic equations.

CO3: Apply concept of interpolation and derive interpolating polynomial using Newton's forward and backward formulae, Lagrange's formulae, Gauss forward and backward formulae.

CO4: Solving initial value problems to ordinary differential equations.

CO5: Determine the process of finding integral equations using Simson's 1/3, Simson's 3/8 Rule and Trapezoidal rule and fitting a best curve using least squares method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1	-

UNIT- I (10 Hrs)

Matrices: Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their Properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Diagonalization of a matrix.

Learning Outcomes: At the end of this unit, students should be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT - II (10 Hrs)

Solution of Algebraic & Transcendental Equations: Introduction-Bisection method-Iterative method-Regula-Falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan Method-Gauss Seidal method.

Learning outcomes: At the end of this unit, students should be able to

- Calculate the roots of equation using Bisection method and Iterative method. (L3)
- Calculate the roots of equation using Regula-Falsi method and Newton Raphson method. (L3)
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Seidal method. (L3)

UNIT - III (10 Hrs)

Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of interpolation. (L2)
- Derive interpolating polynomial using Newton's forward and backward formulae. (L3)
- Derive interpolating polynomial using Lagrange's formulae. (L3)
- Derive interpolating polynomial using Gauss forward and backward formulae. (L3)

UNIT - IV (12 Hrs)

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations- Euler's Method - Modified Euler's Method-Runge-Kutta Methods.

Learning Outcomes: At the end of this unit, students should be able to

- Solve initial value problems to ordinary differential equations using Taylor's method. (L3)
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods. (L3)

UNIT - V (12 Hrs)

Numerical Integration & Curve Fitting:

Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Fitting of straight line – second degree curve –Exponential curve –Power curve by the method of least squares.

Learning Outcomes: At the end of this unit, students should be able to

- Fit a best curve using method of least squares. (L3)
- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule. (L3)
- Solve integral equations using Trapezoidal rule. (L3)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna publishers.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India
3. "Introductory Methods of Numerical Analysis", S. S. Sastry, PHI publishers.

REFERENCE BOOKS:

1. "Higher Engineering Mathematics", B. V. Ramana, Mc Graw Hill publishers.
2. "Advanced Engineering Mathematics", Alan Jeffrey, Elsevier Publishers
3. "A Text Book of Engineering Mathematics Vol – I", T.K.V. Iyengar, B. Krishna Gandhi, S. Chand & Company.

Course Code	PROBABILITY AND STATISTICS (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110110			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize the students with the foundations of probability and statistical methods.
- To impart probability concepts and statistical methods in various applications Engineering.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve the central tendency, correlation and correlation coefficient and regression

CO2: Understand the terminologies of basic probability, two types of random variables and their probability functions.

CO3: Interpret the behavior of various discrete and continuous probability distributions.

CO4: Apply the concept of hypothesis testing for large samples.

CO5: Apply the statistics for testing the significance of the given small sample data by using t- test, F- test and Chi-square test.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	3	-	-	-	-	-	1	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-1 (12 Hrs)

Statistics Introduction, Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, regression lines, regression coefficients and their properties

Learning Outcomes: At the end of this unit, students should be able to

- summarize the basic concepts of data science and its importance in engineering (L2)
- analyze the data quantitatively or categorically, measure of averages, variability (L4)
- adopt correlation methods and regression analysis (L5)

UNIT-II (11 Hrs)

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Bayes theorem, random variables (discrete and continuous), probability density functions, properties.

Learning Outcomes: At the end of this unit, students should be able to

- Define the terms trial, events, sample space, probability, and laws of probability (L1)

- Make use of probabilities of events in finite sample spaces from experiments (L3)
- Apply Bayes theorem to real time problems (L3)
- Explain the notion of random variable, distribution functions and expected value (L2)

UNIT-III (12 Hrs)

Probability distributions: Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (L3)
- Interpret the properties of normal distribution and its applications (L2)

UNIT-IV (11 Hrs)

Estimation and Testing of hypothesis, large sample tests: Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of estimation, interval estimation and confidence intervals (L2)
- Apply the concept of hypothesis testing for large samples (L4)

UNIT-V (11 Hrs)

Small sample tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the concept of testing hypothesis for small samples to draw the inferences (L3)
- Estimate the goodness of fit (L5)

TEXTBOOKS:

1. "Miller and Freund's Probability and Statistics for Engineers", Richard A. Johnson, Pearson, 7/e, 2008.
2. "Fundamentals of Mathematical Statistics", S.C. Gupta and V.K. Kapoor, S. Chand & Sons Publications, 11/e, 2012.

REFERENCE BOOKS:

1. "A First Course in Probability", S. Ross, Pearson Education India, 2002.
2. "An Introduction to Probability Theory and its Applications", W. Feller, Wiley Publications, 1/e, 1968.
3. "Probability, Random Variables & Random Signal Principles", Peyton Z. Peebles, McGraw Hill Education, 4/e, 2001.

<table>
<tr><td>Course Code</td><td rowspan="2" colspan="2">ENGINEERING DRAWING
(Common to all branches)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A030301</td><td>1</td><td>0</td><td>4</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">II</td></tr>
</table>

COURSE OBJECTIVES:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.
- Instruct graphical representation of machine components.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Construction of various conic curves, Cycloid curves
CO2: Construction of projections of Points, Lines applied in engineering
CO3: Construction of projections of Planes.
CO4: Construction of projection of solids development of surfaces regular Solids .
CO5: Representation of Ortho and Isometric views of solids.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO4	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO5	3	2	2	-	3	-	-	-	-	2	-	2	2	2

UNIT-I (12 Hrs)

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance - Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, Epi-cycloid and Hypocycloid - general method only.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of engineering drawing (L2)
- Know the conventions used in the engineering drawing (L1)
- Identify the curves obtained in different conic sections (L2)
- Draw different cycloidal curves. (L3)

UNIT– II (12 Hrs)

Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, true angle made by line.

Learning Outcomes: At the end of this unit, students should be able to

- Know how to draw the projections of points, lines (L1)
- Find the true length of the lines. (L2)

UNIT-III (18 Hrs)

Projection of planes: Projections of regular plane inclined to both the planes and also draw the projections of different planes in Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of planes. (L2)
- Draw the projection of plane inclined to one plane and both the planes. (L3)
- Understand the different commands used in Computerized drawing to draw different planes. (L2)

UNIT- IV (15 Hrs)

Projections of solids: Projections of regular solids inclined to one or both planes by rotational method.

Development of Solids: Development of lateral Surfaces of Right Regular Solids (without section)-Prism, Cylinder, Pyramid, Cone.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of solids. (L2)
- Draw the projection of solid inclined to one plane. (L3)
- Draw the projection of solids inclined to both the planes. (L3)

UNIT–V (18 Hrs)

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale-Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Conversion of Isometric Views to Orthographic Views. Drawing the Isometric views using Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the basics convectional representation of different projections (L1)
- Draw the Orthographic projection of simple solids. (L3)
- Draw the Isometric projection of simple solids. (L3)

TEXTBOOKS:

1. "Engineering Drawing", K. L. Narayana & P. Kannaiah, SciTech Publishers, Chennai, 3/e.
2. "Engineering Drawing + AutoCAD", K. Venugopal, V. Prabhu Raja, New Age Publishers.
3. "Engineering Drawing", N. D. Bhatt, Charotar Publishers, 53/e, 2016

REFERENCE BOOKS:

1. "Engineering Drawing", Dhanajay A Jolhe, Tata McGraw-Hill, Copy Right, 2009.
2. "Engineering Drawing", Basant Agarwal & C. M. Agarwal, Tata McGraw-Hill
3. "Engineering Drawing", Shah and Rana, Pearson Education, 2/e, 2009

Course Code	ADVANCED DATA STRUCTURES THROUGH C++ (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050304			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	II			

COURSE OBJECTIVES:

- To be familiar with basic techniques of object-oriented principles and exception handling using C++
- To be familiar with the concepts like Inheritance, Polymorphism
- Solve problems using data structures such as linear lists, stacks, queues
- Be familiar with advanced data structures such as balanced search trees.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Distinguish between procedures and object-oriented programming.
CO2: Apply advanced data structure strategies for exploring complex data structures.
CO3: Compare and contrast various data structures and design techniques in the area of Performance.
CO4: Implement data structure algorithms through C++.
CO5: Incorporate data structures into the applications such as binary search trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

UNIT-1 (13 Hrs)

ARRAYS: Abstract Data Types and the C++ Class, An Introduction to C++ Class- Data Abstraction and Encapsulation in C++- Declaring Class Objects and Invoking Member Functions- Special Class Operations- Miscellaneous Topics- ADTs and C++Classes, The Array as an Abstract Data Type, The Polynomial Abstract Data type- Polynomial Representation- Polynomial Addition. Spares Matrices.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about OOPS concepts (L3).
- Learn and solve about different types of Class Types and Polynomial representation (L3)

UNIT- II (10 Hrs)

STACKS AND QUEUES: Templates in C++, Template Functions- Using Templates to Represent Container Classes, The Stack Abstract Data Type, The Queue Abstract Data Type, Subtyping and Inheritance in C++, Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix.

Learning Outcomes At the end of this unit, students should be able to

- Translate the given function as Templates in C++ (L3)
- Analyze the behaviour of different types of Classes, ADT and Expressions (L3)

UNIT – III (12 Hrs)

LINKED LISTS – I: Single Linked List and Chains, Representing Chains in C++, defining a Node in C++- Designing a Chain Class in C++- Pointer manipulation in C++- Chain Manipulation Operations, The Template Class Chain, Implementing Chains with Templates- Chain Iterators- Chain Operations- Reusing a Class, Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials,

Learning Outcomes: At the end of this unit, students should be able to

- Learn and implement different types of Linked Lists (L3)
- Acquire the Knowledge of functions of Templates in C++ (L1)
- Implement Chain Iterators and Polynomials (L3)

UNIT – IV (13 Hrs)

LINKED LISTS – II: Polynomial Representation- Adding Polynomials- Circular List Representation of Polynomials, Equivalence Classes, Sparse Matrices, Sparse Matrix Representation- Sparse Matrix Input- Deleting a Sparse Matrix, Doubly Linked Lists, Generalized Lists, Representation of Generalized Lists- Recursive Algorithms for Lists Reference Counts, Shared and Recursive Lists

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables using Polynomial Representation (L5)
- Apply Matrix techniques in evaluating different types (L4)
- Evaluating Generalized Lists and Recursive algorithms (L5)

UNIT-5 (12 Hrs)

TREES: Introduction, Terminology, Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Tress, Binary Tree Representations, Binary Tree Traversal and Tree Iterators, Introduction, Inorder Traversal Preorder Traversal, Postorder Traversal, Thread Binary Trees, Threads, Inorder Traversal of a Threaded Binary Tree, Inserting a Node into a Threaded Binary Tree, Heaps, Priority Queues, Definition of a Max Heap, Insertion into a Max Heap, Deletion from a Max Heap, Binary Search Trees, Definition, Searching a Binary Search Tree, Insertion into a Binary Search Tree, Deletion from a Binary Search Tree, Height of Binary Search Tree.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Tree functions and its relations (L2)
- Conclude the use of different types of Trees representation (L4)

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2^{nd} edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2^{nd} edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3^{rd} Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W.Savitch, Pearson education, Fourth edition

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A020303			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To teach DC and AC electrical circuit analysis
- To explain working principles of transformers and electrical machines
- To impart knowledge on Power system generation, transmission and distribution
- Familiar with the theory, construction, and operation of electronic devices
- Learn about biasing of BJTs and FETs.
- Design and construct amplifiers, understand the concept & principles of logic devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply concepts of KVL/KCL in solving DC circuits
CO2: Illustrate working principles of DC Motor, Transformer and Induction motors
CO3: Understand the basics of Power generation, Transmission and Distribution
CO4: Explain the theory, construction, operation and working of electronic devices.
CO5: Analyze and design small signal amplifier circuits, logic gate, combinational and sequential circuits

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

Part A: Basic Electrical Engineering

UNIT-I (10 Hrs)

DC & AC Circuits: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms -peak and rms values - phasor representation - real power - reactive power - apparent power – power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

Learning Outcomes: At the end of this unit, students should be able to

- Recall Kirchoff laws (L1)

- Analyze simple electric circuits with DC excitation (L4)
- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations (L4)

UNIT-II (10 Hrs)

DC & AC Machines: Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator –principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single-Phase Transformer - OC and SC tests on transformer -Principle and operation of 3-phase AC machines [Elementary treatment only]

Learning Outcomes: At the end of this unit, students should be able to

- Explain principle and operation of DC Generator & Motor. (L2)
- Perform speed control of DC Motor (L3)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor - DC motor (L2)

UNIT-III (10 Hrs)

Basics of Power Systems: Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary& Secondary distribution systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand working operation of various generating stations (L1)
- Explain the types of Transmission and Distribution systems (L2)

TEXTBOOKS:

1. "Basic Electrical Engineering", D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2010.
2. "Principles of Power System", V.K. Mehta & Rohit Mehta, S. Chand, 2018.

REFERENCE BOOKS:

1. "Fundamentals of Electrical Engineering", L. S. Bobrow, Oxford University Press, 2011.
2. "Electrical and Electronics Technology", E. Hughes, Pearson, 2010.
3. "Generation Distribution and Utilization of Electrical Energy", C.L. Wadhwa, New Age International Publications, 3rd Edition.

Part 'B'- Electronics Engineering

UNIT-I (10 Hrs)

Diodes and Applications: Semiconductor Diode, Diode as a Switch& Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications of Zener Diode, LED, Photo Diode.

Transistor Characteristics: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Biasing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

Learning outcomes: At the end of this unit, students should be able to

- Remember and understand the basic characteristics of semiconductor diode. (L1)
- Understand principle of operation of Zener diode and other special semiconductor diodes (L1)
- Analyze BJT based biasing circuits. (L3)
- Design an amplifier using BJT based on the given specifications. (L4)

UNIT-II (10 Hrs)

Operational Amplifiers and Applications: Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

Learning outcomes: At the end of this unit, students should be able to

- Describe operation of Op-Amp based linear application circuits, converters, amplifiers and non-linear circuits. (L2)
- Analyze Op-Amp based comparator, differentiator and integrator circuits. (L3)

UNIT-III (10 Hrs)

Digital Electronics: Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder. Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters.

Learning outcomes: At the end of this unit, students should be able to

- Explain the functionality of logic gates. (L2)
- Apply basic laws and De Morgan's theorems to simplify Boolean expressions. (L3)
- Analyze standard combinational and sequential circuits. (L4)

TEXTBOOKS:

1. "Electronic Devices & Circuit Theory", R. L. Boylestad & Louis Nashlesky, Pearson Education, 2007.
2. "Op-Amps & Linear ICs", Ramakanth A. Gayakwad, Pearson, 4th Edition, 2017.
3. "Modern Digital Electronics", R. P. Jain, Tata Mcgraw Hill, 3rd Edition, 2003.
4. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2nd Edition, 2012.

REFERENCE BOOKS:

1. "Basic Electronics - Devices, Circuits and IT Fundamentals", Santiram Kal, Prentice Hall of India, 2002.
2. "A Text Book of Electronic Devices and Circuits", R. S. Sedha, S.Chand & Co, 2010.
3. "Introductory Electronic Devices & Circuits - Conventional Flow Version", R. T. Paynter, Pearson Education, 2009.

Course Code	COMMUNICATIVE ENGLISH LAB (Common to all branches)		L	T	P	C
21A110201			0	0	2	1
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with special emphasis on Listening and Speaking skills.
- To equip students with professional skills & soft skills, Develop communication skills in formal and informal situations
- To help students present themselves confidently during Group Discussions and Oral Presentations

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use creativity in listening to formal and informal conversations.
CO2: Analyze the concepts of active listening and barriers to listening.
CO3: Communicate effectively in everyday life using right oral expressions.
CO4: Acquire the confidence to present themselves effectively during academic and professional presentations.
CO5: Acquire basic knowledge of non-verbal communication and its importance.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	3	-	-	-	-	-

UNIT-I (6 Hrs)

Essentials of Listening: Purpose of Listening, Listening to Conversation (Formal and Informal), Active Listening- an Effective Listening Skill, Barriers to Listening, Listening to Announcements- (railway/ bus stations/ airport /sports announcement/commentaries etc.)

Learning Outcomes: At the end of this unit, students should be able to

- Know the difference between hearing and listening. (L2)
- Understand the purpose of active listening. (L2)
- Follow the announcements through focused listening. (L2)

UNIT-II (6 Hrs)

Listening Comprehension: Academic Listening (Listening to Lectures), Listening to Short Talks and Listening to Presentations, Note Taking Tips

Learning Outcomes: At the end of this unit, students should be able to

- Comprehend different academic lectures. (L3)
- Take notes while listening to short talks and lectures. (L3)
- Improve comprehension skills through listening to short talks and presentations. (L3)

UNIT-III (6 Hrs)

Communicating in everyday life: Asking for and giving information, Offering and responding to offers, Requesting and responding to requests, Congratulating people on their success, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving,

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate expressions to communicate in everyday life. (L3)
- Communicate effectively in different contexts of conversations. (L3)
- Participate in role plays and situational dialogues with an exposure to social and professional contexts. (L3)

UNIT- IV (6 Hrs)

Presentation Skills: Giving Short Talks, Preparing power point presentation, Greeting and Introducing in presentations, Presenting a paper, Participating in group discussions (dos & don'ts)

Learning Outcomes: At the end of this unit, students should be able to

- Prepare a power point presentation effectively. (L3)
- Present a paper in a seminar. (L3)
- Participate in Group Discussions efficiently. (L3)

UNIT-V (6 Hrs)

Non-verbal Communication: Personal Appearance, Gestures, Postures, Facial Expression, Eye Contact, Body Language (Kinesics), Silence, Tips for Improving Non-Verbal Communication

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of body language in communication (L2)
- Improve non-verbal communication skills (L3)
- Understand how body language and non-verbal communication affects the personality of an individual in a social and professional set-up. (L2)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://learnenglish.britishcouncil.org/skills/listening
2. https://agendaweb.org/listening/comprehension-exercises.html
3. https://www.123listening.com/
4. https://www.linguahouse.com/learning-english/skill-4-learners/listening
5. https://www.talkenglish.com/listening/listen.aspx
6. https://ed.ted.co

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A020304			0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To Verify Kirchoff's laws and Superposition theorem
- To learn performance characteristics of DC Machines and 1- Phase Transformer
- To Study the I – V Characteristics of Solar PV Cell
- To analyze the characteristics of Diodes, BJT, MOSFET, UJT
- To design the amplifier circuits from the given specifications.
- Exposed to linear and digital integrated circuits

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Understand Kirchoff's Laws & Superposition theorem.

CO2: Analyze the various characteristics on 1-phase transformer and DC Machines by conducting various tests.

CO3: Analyze I – V Characteristics of PV Cell

CO4: Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.

CO5: Construct and analyze the various diode rectifiers, clippers and clampers and other circuits.

CO-PO MAPPING;

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

PART A: ELECTRICAL ENGINEERING

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Load test on 1-Phase Transformer.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

PART B: ELECTRONICS ENGINEERING

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Full Wave Rectifier with & without filter.
4. Wave Shaping Circuits. (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration.
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting amplifiers using Op-AMPs.
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
9. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs all the required active devices

Note: Minimum of Six Experiments to be performed in each section.

Course Code	ADVANCED DATA STRUCTURES THROUGH C++ LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050305			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	II			

COURSE OBJECTIVES:

- To familiarize Advanced data structures using C++.
- To train the students on the sorting techniques
- To introduce Trees.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C++ using Trees.
CO3: Modularize the problem and also solution.
CO4: Design applications in C++ using Searching Techniques
CO5: Explore various operations on Linked Lists

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

1. Write a C++ program to sort the given data elements using bubble sort technique.
2. Write a C++ program to sort the given data elements using selection sort technique.
3. Write a C++ program to search a given element from the list of elements using linear search technique.
4. Write a C++ program to search a given element from the list of elements using binary search technique.
5. Write a C++ program to implement Stack ADT using an array.
6. Write a C++ program to implement Linear Queue ADT using an array.
7. Write a C++ program to implement Circular Queue ADT using an array.
8. Write a C++ program to implement Deque ADT using an array.
9. Write a C++ program to create a Single linked list ADT and display the elements.
10. Write a C++ program to create a Double linked list ADT and display the elements.
11. Write a C++ program to create a Circular single linked list and display the elements.
12. Write a C++ program to create a Circular double linked list and display the elements.
13. Write a C++ program to implement Stack ADT using linked list.
14. Write a C++ program to implement Linear Queue ADT using linked list.

15. Write a C++ program to create a binary search tree with the given data elements 23, 54, 12, 43, 56, 10, 52, 35 and apply In-order, Preorder and Post-order tree traversal techniques.

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2nd edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2nd edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3rd Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W. Savitch, Pearson education, Fourth edition

Course Code	ENVIRONMENTAL SCIENCE		L	T	P	C
21A000001	(Common to CE, ME, EEE, ECE, CSE, CSE-IOT)		**2**	**0**	**0**	**0**
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo- chemical cycles and ecological pyramids.

CO3: Understand various causes of pollution and solid waste management and related preventive measures.

CO4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5: Casus of population explosion, value education and welfare programmes.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO2	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO3	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO5	-	-	-	-	-	1	2	1	-	-	-	1	-	-

UNIT – I (10 Hrs)

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance, Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associatedproblems–Forestresources–Useandover–exploitation,deforestation,casestudies - Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of public awareness (L1)
- Know about the various resources (L1)

UNIT–II (10 Hrs)

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes: At the end of this unit, students should be able to

- Know about various echo systems and their characteristics (L1)
- Know about the biodiversity and its conservation (L1)

UNIT – III (10 Hrs)

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the various sources of pollution. (L1)
- Know about the various sources of solid waste and preventive measures. (L1)
- Know about the different types of disasters and their managerial measures. (L1)

UNIT- IV (10 Hrs)

Social Issues and The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, water shed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the social issues related to environment and their protection acts. (L1)
- Know about the various sources of conservation of natural resources. (L1)
- Know about the wild life protection and forest conservation acts. (L1)

UNIT – V (10 Hrs)

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the population explosion and family welfare programmes. (L1)
- Identify the natural assets and related case studies. (L1)

TEXTBOOKS:

1. "Text book of Environmental Studies for Undergraduate Courses", Erach Bharucha for University Grants Commission, Universities Press.
2. "Environmental Studies", Palani swamy, Pearson education
3. "Environmental Studies", S. Azeem Unnisa, Academic Publishing Company
4. "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", K. Raghavan Nambiar, SCITECH Publications (India), Pvt. Ltd.

REFERENCE BOOKS:

1. "Textbook of Environmental Science", Deeksha Dave and E. Sai Baba Reddy, Cengage Publications.

2. “Text book of Environmental Sciences and Technology”, M. Anji Reddy, BS Publication.
3. “Comprehensive Environmental studies”, J. P. Sharma, Laxmi publications.
4. “Environmental Sciences and Engineering”, J. Glynn Henry and Gary W. Heinke, Prentice Hall of India Private limited
5. “A Text Book of Environmental Studies”, G. R. Chatwal, Himalaya Publishing House
6. “Introduction to Environmental Engineering and Science”, Gilbert M. Masters and Wendell P. Ela, Prentice Hall of India Private limited.

Course Code	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110111			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To explain about the Boolean algebra, Graph theory and Recurrence relations.
- To demonstrate the application of basic methods of discrete mathematics in Computer Science problem solving.
- To elucidate solving mathematical problems from algorithmic perspective.
- To introduce the mathematical concepts which will be useful to study advanced courses
- Design and Analysis of Algorithms, Theory of Computation, Cryptography and Software Engineering etc.
- To reveal how solutions of graph theory can be applied to computer science problems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Evaluate elementary mathematical arguments and identify fallacious reasoning

CO2: Understand the properties of Compatibility, Equivalence and Partial Ordering relations, Lattices and Hassee Diagrams and the general properties of Algebraic Systems

CO3: Design solutions for problems using Permutations and Combinations

CO4: Solve the homogeneous and non-homogeneous recurrence relations

CO5: Apply the concepts of functions to identify different types of Graphs and trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Statements and Notation, **Connectives-** Negation, Conjunction, Disjunction, Conditional and Bi-conditional, Statement formulas and Truth Tables. Well-formed formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications.

Normal Forms: Disjunctive Normal Forms, Conjunctive Normal Forms, Principal Disjunctive Normal Forms (PDNF), Principal Conjunctive Normal Forms (PCNF), Ordering and Uniqueness of Normal Forms.

The Theory of Inference for the Statement Calculus: Rules of Inference, Consistency of Premises and Indirect Method of Proof. The predicate Calculus, Inference theory of the Predicate Calculus

Learning Outcomes: At the end of this unit, students should be able to

- Describe logical sentences in terms of predicates, quantifiers, and logical connectives (L1)
- Evaluate basic logic statements using truth tables and the properties of logic (L5)
- Apply rules of inference to test the consistency of premises and validity of arguments (L3)
- Verify the equivalence of two formulas and their duals (L4)
- Find the Principal Conjunctive and Principal Disjunctive Normal Forms of a statement formula. (L1)

UNIT-II (12 Hrs)

Set Theory: Basic concepts of Set Theory, Representation of Discrete structures, Relations and Ordering, Functions, Recursion.

Lattices and Boolean algebra: Lattices as Partially Ordered Sets, Boolean algebra, Boolean Functions, Representation and Minimization of Boolean Functions.

Algebraic Structures: Algebraic Systems: Examples and General Properties, Semi Groups and Monoids, Groups.

Learning Outcomes: At the end of this unit, students should be able to

- Describe equivalence, partial order and compatible relations (L1)
- Compute Maximal Compatibility Blocks (L3)
- Identify the properties of Lattices (L2)
- Evaluate Boolean functions and simplify expression using the properties of Boolean Algebra (L5)
- Infer Homomorphism and Isomorphism (L4)
- Describe the properties of Semi groups, Monoids and Groups (L1)

UNIT-III (10 Hrs)

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Permutations and Combinations with constrained Representations, Binomial Coefficients, The Binomial and Multinomial Theorems, The Principle of Inclusion and Exclusion

Learning Outcomes: At the end of this unit, students should be able to

- Explain fundamental principle of counting (L2)
- Examine the relation between permutation and combination (L4)
- Solve counting problems by applying elementary counting techniques using the product and sum rules (L3)
- Apply permutations, combinations, the pigeon-hole principle, and binomial expansion to solve counting problems (L3)

UNIT-IV (10 Hrs)

Recurrence Relations: Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, The method of Characteristic Roots, Solution of Inhomogeneous Recurrence Relations.

Learning Outcomes: At the end of this unit, students should be able to

- Find the generating functions for a sequence (L1)
- Design recurrence relations using the divide-and-conquer algorithm (L6)
- Solve linear recurrence relations using method of Characteristic Roots (L3)
- Outline the general solution of homogeneous or Inhomogeneous Recurrence Relations using substitution and method of generating functions (L2)
- Solve problems using recurrence relations and recursion to analyze complexity of Algorithms (L3)

UNIT-V (10 Hrs)

Graphs: Basic Concepts, Isomorphism and Sub graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatics Number, The Four-Color Problem

Learning Outcomes: At the end of this unit, students should be able to

- Investigate if a given graph is simple or a multigraph, directed or undirected, cyclic or acyclic (L4)
- Describe complete graph and complete bipartite graphs (L1)
- Identify Euler Graphs, Hamilton Graph and Chromatic Number of a graph (L2)
- Apply the concepts of functions to identify the Isomorphic Graphs (L3)
- Apply depth-first and breadth-first search (L3)
- Apply Prim's and Kruskal's algorithms to find a minimum spanning tree (L3)

TEXTBOOKS:

1. "Discrete Mathematics for Computer Scientists & Mathematicians", Joe L. Mott. Abraham Kandel and Theodore P. Baker, Pearson, 2008, 2nd Edition,
2. "Discrete Mathematical Structures with Applications to Computer Science", J P Trembly and R Manohar, McGraw Hill, 2017, 1st Edition.

REFERENCE BOOKS:

1. "Discrete and Combinatorial Mathematics, an Applied Introduction", Ralph P. Grimaldi and B.V. Ramana, Pearson, 2016, 5th Edition.
2. "Graph Theory with Applications to Engineering", Narsingh Deo, Prentice Hall, 1979.
3. "Discrete Mathematics theory and Applications", D.S. Malik and M.K. Sen, Cengage Learning, 2012, 1st Edition.

4. "Elements of Discrete Mathematics, A computer Oriented approach", C L Liu and D P Mohapatra, McGraw Hill, 2018, 4^{th} edition.

Course Code	DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050401			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To understand the basic theoretical concepts of digital systems like the binary system and Boolean algebra.
- To express real life problem in logic design terminology.
- To use Boolean algebraic formulations to design digital systems. To design using combinational/sequential circuits
- To understand the Instruction execution stages.
- To explain the functions of the various computer hardware components.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the basic functional units and different ways of interconnecting to form a computer system.
CO2: Design; understand the number systems, combinational sequential circuits.
CO3: Inspect the Computer Arithmetic operations performed on fixed point and floating-point numbers.
CO4: Apply effective memory management strategies
CO5: Describe various techniques for I/O data transfer methods and interrupt handling mechanisms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	-	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	1		-	-	-	-	-	-	-	-	-

UNIT- I (12 Hrs)

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations.

Data Representation: Binary Numbers, Fixed Point Representation. Floating – Point Representation. Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Identify the basic functional units and different ways of interconnecting to form a computer system. (L2)

- Summarize the binary number system (L2)
- Illustrate various binary codes (L3)

<u>UNIT- II</u> (12 Hrs)

Digital Logic Circuits - I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. Flip-flops, Combinational Circuits.

Digital Logic Circuits - II: Registers, Shift Registers, Binary counters, Decoders, Multiplexers, Programmable Logic Devices.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Develop a logic diagram using gates from a Boolean function (L3)
- Apply the map method for simplifying Boolean Expressions. (L2)
- Analyze and design combinational circuits. (L3)
- Explain the functionalities of latch and different flip-flops (L2)

<u>UNIT- III</u> (12 Hrs)

Computer Arithmetic: Algorithms for fixed point and floating-point addition, subtraction, multiplication and division operations, Hardware Implementation of arithmetic and logic operations, High performance arithmetic.

Instruction Set & Addressing: Memory Locations and Addresses, Machine addresses and sequencing, Various Addressing Modes, Instruction Formats, Basic Machine Instructions, IA-32 Pentium example.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Illustrate various addressing modes for accessing register and memory operands. (L3)
- Describe the instruction sequencing and various types of instructions. (L2)
- Describe the operations performed on floating point numbers. (L2)

<u>UNIT- IV</u> (11 Hrs)

Processor Organization: Introduction to CPU, Register Transfers, Execution of Instructions, Multiple Bus Organization, Hardwired Control, Microprogrammed Control.

Memory Organization: Concept of Memory, RAM, ROM memories, memory hierarchy, cache memories, virtual memory, secondary storage, memory management requirements.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Distinguish between hardwired and micro programmed control units. (L3)
- Recognize the various types of memories. (L2)
- Analyze the performance of cache memory. (L3)
- Apply effective memory management strategies (L2)

UNIT- V (11 Hrs)

Input / Output Organization: Introduction to I/O, Interrupts- Hardware, Enabling and disabling Interrupts, Device Control, Direct memory access, buses, interface circuits, standard I/O Interfaces.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Examine the basics of I/O data transfer synchronization. (L3)
- Analyze the interrupt handling mechanisms of various processors. (L3)
- Describe various techniques for I/O data transfer methods. (L2)

TEXTBOOKS:

1. "Computer Organization", Carl Hamacher, ZvonkoVranesic, SafwatZaky, McGraw Hill, 5th edition.
2. "Computer Architecture and Organization- An Integrated Approach", Miles Murdocca, Vincent Heuring, Wiley India, Second Edition.
3. "Computer Systems Architecture", M. Morris Mano, Pearson, 3rd Edition.

REFERENCE BOOKS:

1. "Computer Organization and Architecture", William Stallings, Pearson, Sixth Edition,
2. "Computer - organization and Design", David A. Paterson and John L. Hennessy, Elsevier.
3. "Fundamentals or Computer Organization and Design", Sivarama Dandamudi, Springer Int. Edition.
4. "Digital Design", M. Morris Mano, Pearson Education/PHI, Third Edition
5. "Fundamentals of Logic Design", Roth, Thomson, 5th Edition.

Course Code	DATABASE MANAGEMENT SYSTEMS		L	T	P	C
21A050402	(Common for CSE, CSE-AI, AIML, CSE-IOT)		**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Train in the fundamental concepts of database management systems, database modelling and design, SQL, PL/SQL and system implementation techniques.
- Enable students to model ER diagram for any customized application
- Inducting appropriate strategies for optimization of queries.
- Provide knowledge on concurrency techniques
- Demonstrate the organization of Databases

COURSE OUTCOMES

After completion of the course, the student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		-	-	-	-	-	-	-	2	1	-
CO2	3	2	3	3	-	-	-	-	-	-	3	3	1	-
CO3	-	2	3	3	-	-	-	-	-	-	2	-	1	-
CO4	-	2	-	3	2	-	-	-	-	-	-	-	-	2
CO5	-	-	-	3	3	-	-	-	-	-	-	3	-	2

UNIT-I (12 Hrs)

Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators.

Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish between Database and File System (L3)
- Categorize different kinds of data models (L4)
- Define functional components of DBMS (L1)

UNIT-II (12 Hrs)

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL**:** Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization.

Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Outline the elements of the relational model such as domain, attribute, tuple, relation, and entity (L4)
- Distinguish between various kinds of constraints like domain, key, and integrity (L4)
- Define relational schema (L1)
- Develop queries using Relational Algebra and SQL (L6)
- Perform DML operations on databases (L3)

UNIT-III (12 Hrs)

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues.

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms

***Learning Outcomes*:** At the end of this unit, students should be able to

- Develop E-R model for the given problem (L6)
- Derive tables from E-R diagrams (L6)
- Differentiate between various normal forms based on functional dependency (L4)
- Apply normalization techniques to eliminate redundancy (L3)

UNIT-IV (11 Hrs)

Query Processing: Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions.

Query optimization: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Identify variety of methods for effective processing of given queries. (L2)
- Obtain knowledge related to optimization techniques. (L6)

UNIT-V (12 Hrs)

Transaction Management: Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.

Concurrency Control: Lock based Protocols, Deadlock Handling, Multiple granularities, Timestamp based Protocols, Validation based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Non-volatile Storage, Early Lock Release and Logical Undo Operations.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand various properties of transaction. (L2)
- Design atomic transactions for an application. (L6)
- Gain the knowledge about log mechanism and check pointing techniques for system recovery. (L6)

TEXTBOOKS:

1. "Database System Concepts" A. Silberschatz, H. F. Korth, S. Sudarshan, TMH, 2019, 6/e.

REFERENCE BOOKS:

1. "Database Management System", Shamkant B. Navathe, Ramez Elmasri, PEA, 6/e.
2. "Database Principles Fundamentals of Design Implementation and Management", Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
3. "Database Management Systems", Raghurama Krishnan, Johannes Gehrke, TMH, 3/e.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA (Common for CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050403			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

COURSE OUTCOMES:

Students will be able to:

CO1: To solve real world problems using OOP techniques.
CO2: To apply code reusability through inheritance, packages, and interfaces
CO3: To develop applications by using parallel streams for better performance.
CO4: To solve problems using java collection framework and I/O classes.
CO5: To develop applets for web applications, to build GUIs and handle events generated by user interactions, to use the JDBC API to access database

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	3	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	3	-	-	-	-	-	3	3	-	2

UNIT–I (12 Hrs)

Introduction: Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the syntax, semantics, and features of Java Programming Language. (L2)
- Learn object-oriented features and understanding type conversion and casting. (L2)
- Understand different types of string handling functions and its usage. (L2)

UNIT–II (10 Hrs)

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, finding packages and CLASSPATH, Access Protection, Importing packages.

Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

Learning Outcomes**:** At the end of this unit, students should be able to

- Implement types of Inheritance and developing new classes based on existing classes (L3)
- Distinguish between system packages and user defined packages. (L4)
- Demonstrate features of interfaces to implement multiple inheritances. (L3)

UNIT – III (12 Hrs)

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes.

Stream based I/O (java.io) – The Stream Classes-Byte streams and Character streams, reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

Learning Outcomes**:** At the end of this unit, students should be able to

- Learn what exceptions are and how they are handled. (L2)
- Learn when to use exception handling and how to create user defined exceptions (L6)
- Learn the difference between various files and streams. (L4)

UNIT – IV (12 hrs)

Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hash table, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

Learning Outcomes**:** At the end of this unit, students should be able to

- Understand concurrency, parallelism, and multithreading (L2)
- Learn the importance of collections and use prebuilt generic data structures from framework. (L3)

UNIT-V (12 hrs)

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirm dialog, show input dialog, show option dialog, jdialog, create a modeles sdialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Learning Outcomes: At the end of this unit, students should be able to

- Learn how to use the Nimbuslook-and-feel (L3)
- Understand the GUI programming. (L2)
- Understand basic steps in developing JDBC applications (L2)

TEXTBOOKS:

1. “Java The complete reference”, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd, 9th edition.
2. “Java How to Program”, Paul Dietel, Harvey Dietel, Pearson Education,10th Edition.

REFERENCE BOOKS:

1. “Understanding Object-Oriented Programming with Java”, T. Budd, Pearson Education, updated edition.
2. “Core Java Volume – 1 Fundamentals”, Cay S. Horstmann, Pearson Education.
3. “Java Programming for core and advanced learners”, Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press
4. “Introduction to Java programming”, Y. Daniel Liang, Pearson Education.
5. Object Oriented Programming through Java”, P. Radha Krishna, “University Press.
6. “Programming in Java”, S. Malhotra, S. Choudhary, Oxford Univ. Press, 2nd edition.
7. “Java Programming and Object-oriented Application Development”, R.A. Johnson, Cengage Learning.

Course Code	FUNDAMENTALS OF DATA COMMUNICATIONS		L	T	P	C
21A350301			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To have a detailed study of various analog and digital modulation and demodulation techniques
- To have a thorough knowledge of various multiplexing schemes and Data communication protocols
- To know about the standards and mechanisms of television systems.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Different modulation techniques to improve the bandwidth and their properties.
CO2: Networking and different protocol systems.
CO3: Error estimation and correction, asynchronous and synchronous protocols.
CO4: Multiplexing techniques, different networking connections and interfacing devices.
CO5: Multiple access techniques and analysis.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

UNIT – I (12 Hrs)

Introduction To Data Communications And Networking: Standards Organizations for Data Communications, Layered Network Architecture, Open Systems Interconnection, Data Communications Circuits, Serial and parallel Data Transmission, Data communications Networks, Alternate Protocol Suites:

Signals, Noise, Modulation, And Demodulation: Signal Analysis, Electrical Noise and Signal-to- Noise Ratio, Analog Modulation Systems, Information Capacity, Bits, Bit Rate, Baud, and M-ary Encoding, Digital Modulation.

Learning Outcomes: At the end of this unit, students should be able to

- Learn data representation in data networks (L2)
- Understand OSI-ISO Reference Model (L2)
- Understand basic steps in data transmissions (L3)
- Learn about Modulation techniques (L2)

UNIT – II (12 Hrs)

Metallic Cable Transmission Media: Metallic Transmission Lines, Transverse

Electromagnetic Waves, Characteristics of Electromagnetic Waves

Optical Fiber Transmission Media: Advantages of Optical Fiber cables, Disadvantages of Optical Fiber Cables, Electromagnetic spectrum, Optical Fiber Communications System Block Diagram, Optical Fiber construction, Propagation of Light Through an Optical fiber Cable, Optical Fiber Modes and Classifications, Optical Fiber Comparison, Losses in Optical Fiber Cables, Light sources, Light Detectors, Lasers.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about types of transmission media (L3)
- Understand the modality of Electromagnetic waves (L2)
- Learn about Fiber Transmission in detail (L3)
- Understand the functionality of Light Sources (L2)

UNIT – III (11 Hrs)

Digital Transmission: Pulse Modulation, Pulse code Modulation, Dynamic Range, Signal Voltage to- Quantization Noise Voltage Ratio, Linear Versus Nonlinear PCM Codes, Companding, PCM Line Speed, Delta Modulation PCM and Differential PCM.

Multiplexing And T- Carriers: Time- Division Multiplexing, T1 Digital Carrier System, Digital Line Encoding, T Carrier systems, Frequency- Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Optical Network.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about Pulse Modulation Techniques (L3)
- Understand the codes used in Transmission (L2)
- Understand basic steps in Multiplexing and T-Carriers (L2)

UNIT – IV (10 Hrs)

Wireless Communications Systems: Electromagnetic Polarization, Electromagnetic Radiation, Optical Properties of Radio Waves, Terrestrial Propagation of Electromagnetic Waves, Skip Distance, Free-Space Path Loss, Microwave Communications Systems, Satellite Communications Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about wireless communication systems (L3)
- Understand Optical properties in radio waves (L2)
- Understand basic steps in Microwave communication systems (L2)
- Understand basic steps in Satellite communication systems (L2)

UNIT –V (10 Hrs)

Telephone Instruments And Signals: The Subscriber Loop, Standard Telephone Set, Basic Telephone Call Procedures, Call Progress Tones and Signals, Cordless Telephones, Caller ID, Electronic Telephones, Paging systems.

Cellular Telephone Systems: First- Generation Analog Cellular Telephone, Personal Communications system, Second-Generation Cellular Telephone Systems, N-AMPS, Digital Cellular Telephone, Interim Standard, Global system for Mobile Communications.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about Telephone working procedures (L3)
- Understand the paging systems (L2)
- Understand basic steps in Cellular Telephone systems (L2)

TEXTBOOKS:

1. "Introduction to Data Communications and Networking", Wayne Tomasi, Pearson Education.

REFERENCE BOOKS:

1. "Data Communications and Networking", Behrouz A Forouzan, TMH, Fourth Edition.
2. "Data and Computer communications", William Stallings, PHI, 8/e.
3. "Computer Communications and Networking Technologies", Gallow, Thomson, Second Edition
4. "Computer Networking and Internet", Fred Halsll, Lingana Gouda Kulkarni, Pearson Education, Fifth Edition.

Course Code	DATABASE MANAGEMENT SYSTEMS LAB		L	T	P	C
21A050404	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To implement the basic knowledge of SQL queries and relational algebra.
- To construct database models for different database applications.
- To apply normalization techniques for refining of databases.
- To practice various triggers, procedures, and cursors using PL/SQL.
- To design and implementation of a database for an organization

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

I. CREATION OF DATA BASE TABLES

1. Create a table called Employee with fields (Empno, Ename, Job, Mgr, Sal)
    a. Add a column commission with domain to the Employee table.
    b. Insert any five records into the table.
    c. Update the column details of job
    d. Rename the column of Employ table using alter command.
    e. Delete the employee whose empno is 19

2. Create department table with fields (Deptno, Deptname, Location).
    a. Add column designation to the department table.
    b. Insert values into the table.
    c. List the records of emp table grouped by dept no.

d. Update the record where dept no is 9.
e. Delete any column data from the table.

II: EXECUTING QUERIES USING DDL AND DML COMMANDS

1. a. Create a user and grant all permissions to the user on employee table.
   b. Insert the any three records in the employee table and use rollback. Check the result.
   c. Add primary key constraint and not null constraint to the employee table.
   d. Insert null values to the employee table and verify the result.
   e. By using the group by clause, display the names who belongs to dept no 10 along with average salary.
   f. Display lowest paid employee details under each department.
   g. Display number of employees working in each department and their department number
2. a. Create a user and grant all permissions to the user on department table
   b. Insert values in the department table and use commit.
   c. Add constraints like unique and not null to the department table.
   d. Insert repeated values and null values into the table.
   e. Calculate the average salary for each different job.
   f. Show the average salary of each job excluding manager.
   g. Show the average salary for all departments employing more than three people.
   h. Display employees who earn more than the lowest salary in department30

III. CASE STUDIES:

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records
10. Supply chain management system

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

REFERENCE BOOKS:

1. "Database Systems", Ramez Elmasri, Shamkant, B. Navathe, Pearson Education, 6th Edition, 2013.
2. "Database System Concepts" Peter Rob, Carles Coronel, Cengage Learning, 7th Edition, 2008.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050405			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To introduce the concepts of Java.
- To Practice object-oriented programs and build java applications.
- To implement java programs for establishing interfaces.
- To implement sample programs for developing reusable software components.
- To establish database connectivity in java and implement GUI applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Recognize the Java programming environment.
CO2: Develop efficient programs using multithreading.
CO3: Design reliable programs using Java exception handling features.
CO4: Extend the programming functionality supported by Java.
CO5: Select appropriate programming construct to solve a problem.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF APPLICATIONS

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records
10. Supply chain management system

For Every Application:

The following Tasks need to be done:

1. Write a java program to create classes and declare variables?
2. Write a java program to create a constructor?
3. Write a java program to perform exception handling to catch runtime exceptions?
4. Write a java program to implement inheritance for increasing reusability of code?
5. Write a java program to create interfaces for achieving data abstraction?
6. Write a java program to create files for input and output data storage?
7. Write a java program for implementing collection framework for effective management of data objects?
8. Write a java program for creating Graphical User Interface using swings?
9. Write a java program for implementing jdbc connectivity for application connecting with database?

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

Course Code	COMMUNICATION SYSTEMS LAB		L	T	P	C
21A350302			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Various analog modulation and demodulation schemes
- Verify sampling theorem
- Analyze various modulated schemes by using spectrum analyzer
- Various associated circuits of analog modulation schemes
- Demonstrate the action of PLL

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Integrate and test AM and FM modulators and demodulators
CO2: Illustrate sampling theorem in different conditions
CO3: Analyze AM and FM signals using Spectrum analyzer
CO4: Test associated circuits such as AGC, pre-emphasis and de-emphasis
CO5: Integrate and test various pulse modulation and demodulation schemes and Estimate lock range and capture range of PLL.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

LIST OF EXPERIMENTS

Week-1

Amplitude Modulation - Mod. & Demod.

Week-2

AM - DSB SC - Mod. & Demod.

Week-3

Spectrum Analysis of Modulated signal using Spectrum Analyser

Week-4

Diode Detector

Week-5

Pre-emphasis & De-emphasis

Week-6

Frequency Modulation - Mod. & Demod.

Week-7

AGC Circuits

Week-8

Sampling Theorem

Week-9

Pulse Amplitude Modulation - Mod. & Demod.

Week-10

PWM, PPM - Mod. & Demod.

Week-11

PLL

Week-12

Radio receiver characteristics

Note: All Twelve experiments should be performed. The students have to calculate the relevant parameters using a) Hardware b) MATLAB Simulink c) MATLAB Communication tool box

Course Code	GRAPHICS DESIGN USING PHOTOSHOP		L	T	P	C
21A050702	(Common to CSE, CSE-IOT)		1	0	2	2
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Acquaint with graphic design techniques, principles of page layout and design, and photo editing.
- Various software, including Adobe Photoshop
- Adobe Illustrator.

COURSE OUTCOMES:

After completing the course student will be able to:

CO1: Identify the analysis tools
CO2: Describes the use of graphics in Animation
CO3: Understand the difficulty of representing and designing games.
CO4: Understand the latest technologies for linking, describing and searching the web.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Week–1 & Week–2: Photoshop Basics
Week–3 & Week–4: Intro to Design Elements
Week–5 & Week–6: Font Portfolio
Week–7 & Week–8: Logos and Ads
Week–9 & Week–10: Photoshop Movie Posters
Week–11 & Week–12: Adobe Illustrator

Course Code	CONSTITUTION OF INDIA		L	T	P	C
21A000002	(Common to all branches)		2	0	0	0
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand historical background of the constitution making and its importance for building a democratic India.

CO2: Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India.

CO4: Analyze the decentralization of power between central, state and local self-government

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO2	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO3	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO4	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO5	-	-	-	-	-	3	-	2	1	-	-	1	-	-

UNIT-I (10 Hrs)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution-Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Indian constitution (L1)
- Apply the knowledge on directive principle of state policy (L3)
- Analyze the History and features of Indian constitution (L4)
- Learn about Preamble, Fundamental Rights and Duties (L1)

UNIT-II (10 Hrs)

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of Indian government (L1)
- Differentiate between the state and central government (L4)
- Explain the role of President and Prime Minister (L2)
- Know the Structure of supreme court and High court (L1)

UNIT-III (10 Hrs)

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of state government (L1)
- Analyze the role of Governor and Chief Minister (L4)
- Explain the role of State Secretariat (L2)
- Differentiate between structure and functions of state secretariat (L4)

UNIT-IV (10 Hrs)

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning Outcomes: At the end of this unit, students should be able to

- Understand the local Administration (L1)
- Compare and contrast district administration's role and importance (L4)
- Analyze the role of Mayor and elected representatives of Municipalities (L4)
- Learn about the role of Zilla Parishath block level organization (L1)

UNIT-V (10 Hrs)

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Learning Outcomes: At the end of this unit, students should be able to

- Know the role of Election Commission (L1)

- Contrast and compare the role of Chief Election commissioner and Commissionerate (L4)
- Analyze the role of state election commission (L4)
- Evaluate various commissions viz SC/ST/OBC and women (L6)

TEXTBOOKS:

1. "Introduction to the Constitution of India", Durga Das Basu, Prentice Hall of India Pvt. Ltd. New Delhi
2. "Indian Constitution", Subash Kashyap, National Book Trust

REFERENCE BOOKS:

1. "Dynamics of Indian Government & Politics", J.A. Siwach,
2. "Constitutional Law of India", H.M.Sreevai, 4th edition in 3 volumes (Universal Law Publication)
3. "Indian Government and Politics", J.C. Johari, Hans India

Course Code	INTERNET OF THINGS		L	T	P	C
21A050406			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Introduce the fundamental concepts of IoT and physical computing
- Expose the student to a variety of embedded boards and IoT Platforms
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with application program interfaces for IoT.
- Enable students to create simple IoT applications.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Choose the sensors and actuators for an IoT application
CO2: Select protocols for a specific IoT application
CO3: Utilize the cloud platform and APIs for IoT applications
CO4: Experiment with embedded boards for creating IoT prototypes
CO5: Design a solution for a given IoT application

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	-	-	1	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO4	3	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	3	2	3	-	-	2	-	-	-	-	-	2

UNIT – I (12 Hrs)

Overview of IoT:

The Internet of Things: An Overview, The Flavor of the Internet of Things, the “Internet” of “Things”, The Technology of the Internet of Things, Enchanted Objects, who is Making the Internet of Things?

Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances.

Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open-source Vs Close source, Tapping into the community.

Learning Outcomes: At the end of this unit, students should be able to

- Explain IoT architecture. (L2)
- Interpret the design principles that govern connected devices (L2)
- Summarize the roles of various organizations for IoT (L2)
- Interpret the significance of Prototyping (L2)

UNIT – II (12 Hrs)

Embedded Devices: Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug Computing: Always-on Internet of Things.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basics of microcontrollers (L2)
- Outline the architecture of Arduino (L2)
- Develop simple applications using Arduino (L3)
- Outline the architecture of Raspberry Pi (L2)
- Develop simple applications using Raspberry Pi (L3)
- Select a platform for a particular embedded computing application (L3)

UNIT – III (11 Hrs)

Communication in the IoT:

Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols

Prototyping Online Components: Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol

Learning Outcomes: At the end of this unit, students should be able to

- Interpret different protocols and compare them (L2)
- Select which protocol can be used for a specific application (L3)
- Utilize the Internet communication protocols for IoT applications (L3)
- Select IoT APIs for an application (L3)
- Design and develop a solution for a given application using APIs (L6)
- Test for errors in the application (L4)

UNIT - IV (11 Hrs)

Business Models: A short history of business models, The business model canvas, Who is the business model for, Models, Funding an Internet of Things startup, Lean Startups.

Manufacturing: What are you producing, Designing kits, Designing printed circuit boards.

Learning Outcomes: At the end of this unit, students should be able to

- Plan the business model (L6)
- Predict the market value (L6)
- Build the product (L6)

UNIT - V (11 Hrs)

Manufacturing continued: Manufacturing printed circuit boards, Mass-producing the case and other fixtures, Certification, Costs, Scaling up software.

Ethics: Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the manufacturing techniques (L2)
- Adapt the Ethics of the IoT (L6)

TEXT BOOK:

1. "Designing the Internet of Things, Adrian McEwen", Hakim Cassimally, Wiley Publications, 2012

REFERENCE BOOKS:

1. "Internet of Things: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti, Universities Press, 2014.
2. "The Internet of Things, Enabling technologies and use cases", Pethuru Raj, Anupama C. Raman, CRC Press.

ONLINE LEARNING RESOURCES:

1. https://www.arduino.cc/

Course Code	SOFTWARE ENGINEERING & OOAD		L	T	P	C
21A050407	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- The students will have a broad understanding of the discipline of software engineering and its application to the development of and management of software systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Knowledge of basic SW engineering methods and practices, and their appropriate application; general understanding of software process models such as the waterfall and evolutionary models. understanding of the role of project management including planning, scheduling, risk management, etc.

CO2: Understanding of software requirements and the SRS document. Understanding of different software architectural styles.

CO3: Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

CO4: Understanding of software testing approaches such as unit testing and integration testing. Understanding of software evolution and related issues such as version management. Understanding on quality control and how to ensure good quality software.

CO5: Understanding of some ethical and professional issues that are important for software engineers. Development of significant teamwork and project-based experience

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO5	2	3	2	1		-	-	-	-	-	-	-	-	2

UNIT- I (12 Hrs)

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize the basic issues in commercial software development. (L3)
- Summarize software lifecycle models. (L5)
- Infer Workout project cost estimates using COCOMO and schedules using PERT and GANTT charts (L3)

UNIT- II (12 Hrs)

Requirements Engineering: Software Requirements, Requirements engineering Process, Requirement's elicitation, Requirements Analysis, Structured Analysis, Data Oriented Analysis, Object oriented Analysis, Prototyping Analysis, Requirements Specification, Requirements Validation, requirement Management.

Learning Outcomes: At the end of this unit, students should be able to

- Identify basic issues in software requirements analysis and specification. (L3)
- Develop SRS document for sample problems using IEEE 830 format. (L5)
- Develop algebraic and axiomatic specifications for simple problems. (L6)

UNIT- III (12 Hrs)

Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Design Methodologies, Structured Design, Object-Oriented Design: Object oriented Analysis and Design Principles. UML Diagrams, Basic Behavioural Modelling: Interactions, Interaction diagrams. Case Study: The Unified Library application.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in software design. (L3)
- Apply the structured, object-oriented analysis and design (SA/SD) technique. (L5)
- Recognize the basic issues in user interface design. (L4)

UNIT- IV (12 Hrs)

Implementation: Coding Principles, Coding Process, Code verification, Code documentation Software Testing: Testing Fundamentals, Test Planning, Black Box Testing, White Box Testing, Levels of Testing, Usability Testing, Regression testing, Debugging approaches.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in coding practice. (L3)
- Recognize the basic issues in software testing. (L5)
- Design test cases for black box and white box testing. (L6)

UNIT- V (11 Hrs)

Software Project Management: Project Management Essentials, What is Project management, Software Configuration Management. Project Planning and Estimation: Project Planning activities, Software Metrics and measurements, Project Size Estimation, Effort Estimation Techniques

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in Software Project Management. (L3)
- Learn and practice project planning activities. (L5)
- Design and develop software metrics and Estimations. (L6)

TEXTBOOKS:

1. "Fundamentals of Software Engineering", Rajib Mall, PHI, 5th Edition, 2018.
2. "Software Engineering- Practioner Approach", Pressman R, McGraw Hill.
3. "Fundamentals of Object-Oriented Design in UML", Meilir Page-Jones, Pearson Education.

REFERENCE BOOKS:

1. "Software Engineering", Somerville, Pearson
2. "Software Engineering Concepts", Richard Fairley, Tata McGraw Hill.
3. "An integrated approach to Software Engineering", Jalote Pankaj, Narosa

Course Code	PYTHON PROGRAMMING & DATA SCIENCE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050306			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To learn the fundamentals of Python.
- To discuss the concepts of Functions and Exceptions.
- To familiarize with Python libraries for Data Analysis and Data Visualization.
- To introduce preliminary concepts in Pattern Recognition and Machine learning.
- To provide an overview of Deep Learning and Data Science models.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.

CO2: Demonstrate proficiency in handling Strings and File Systems.

CO3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.

CO4: Interpret the concepts of NumPy, MatPlotLib, & Pandas as used in Python.

CO5: Implement exemplary applications related to Machine Learning, Deep learning and Data Science Models in Python.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language,

Control Flow Statements: The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions used on Lists, List Methods, The del Statement.

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples
Learning outcomes: At the end of this unit, the students will be able to

- List the basic constructs of Python. (L1)
- Apply the conditional execution of the program (L3)
- Use the data structure lists, Dictionaries and Tuples (L3)

<u>UNIT-II</u> (10 Hrs)
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings,
Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters.
Errors and Exceptions: What Are Exceptions? Exceptions in Python, Detecting and Handling Exceptions, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions
Learning Outcomes: At the end of this unit, students should be able to

- Design programs for manipulating strings (L6)
- Solve the problems by applying the modularity principle. (L3)
- Classify exceptions and explain the ways of handling them. (L4)

<u>UNIT-III</u> (10 hrs)
Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files,
Introduction to **NumPy, Pandas, Matplotlib**.
Exploratory Data Analysis (EDA): Data Science life cycle, Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA.
Data Visualization: Scatter plot, bar chart, histogram, boxplot, heat maps, etc.
Learning Outcomes: At the end of this unit, students should be able to

- Creating file handling scripts. (L6)
- Demonstrate various mathematical operations on arrays using NumPy (L2)
- Analyze and manipulate Data using Pandas (L4)
- Creating static, animated, and interactive visualizations using Matplotlib. (L6)

<u>UNIT-IV</u> (15 hrs)
Introduction to Pattern Recognition and Machine Learning: Patterns, features, pattern representation, the curse of dimensionality, dimensionality reduction.

Classification—linear and non-linear. Bayesian, Nearest neighbor classifier, Logistic regression, Naïve-Bayes, decision trees and random forests; boosting and bagging.
Clustering---partitional and hierarchical; k-means clustering. Regression.
Cost functions, Cross-validation, Confusion matrix, evaluation metrics
Learning Outcomes: At the end of this unit, students should be able to

- Define Patterns and their representation (L1)
- Describe the Classification and Clustering (L2)
- Illustrate cost functions and class imbalance (L3)

<u>UNIT-V</u> (10 hrs)
Introduction to Deep Learning: Perceptron, Multilayer perceptron. Back propagation. Loss functions. Hyper parameter tuning, Overview of RNN, CNN and LSTM.
Overview of Data Science Models: Applications to text, images, recommender systems, image classification, Social network graphs
Learning Outcomes: At the end of this unit, students should be able to

- Describe RNN, CNN and LSTM (L2)
- Explain the applications of Data Science (L2)

<u>TEXTBOOKS:</u>

1. "Think Python", Allen B. Downey, SPD/O'Reilly, 2nd edition, 2016
2. "Doing Data Science, Straight Talk from the Frontline", Cathy O'Neil, Rachel Schutt, O'Reilly, 2013.
3. "Pattern Recognition and Machine Learning", Christopher Bishop, Springer, 2007.

<u>REFERENCE BOOKS:</u>

1. "Introduction to Python Programming", Gowri Shankar S, Veena A, CRC Press/Taylor & Francis, 1st Edition, 2018. ISBN-13: 978-0815394372,
2. "Python Data Science Handbook: Essential Tools for Working with Data", Jake Vander Plas, O'Reilly Media, 1st Edition, 2016. ISBN-13: 978-1491912058
3. "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Aurelien Geron, O'Reilly Media, 2nd Edition, 2019. ISBN – 13: 978-9352139057
4. "Core Python Applications Programming", Wesley J Chun, Pearson Education India, 3rd Edition, 2015. ISBN-13: 978-9332555365.
5. "Flask Web Development: Developing Web Applications with Python", Miguel Grinberg, O'Reilly Media, 2nd Edition, 2018. ISBN-13: 978-1491991732.

Course Code	MICROPROCESSORS AND MICROCONTROLLERS (Common to CSE, CSE-IOT)		L	T	P	C
21A050309			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers
- To impart knowledge on addressing modes, instruction set and assembly language programming of 8086 and 8051
- To demonstrate memory and I/O interfacing with 8086
- To describe the architecture and features of Intel 8051 microcontroller
- To explain the interfacing of external I/O devices with 8051 microcontrollers

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the concepts of 8086 microprocessors

CO2: Explain addressing modes of 8086 and develop assembly language programs for various problems

CO3: Describe the interfacing of 8086 with memory and peripheral devices

CO4: Distinguish between microprocessor and microcontroller and explain the concepts of 8051 microcontrollers

CO5: Explain the interfacing of external devices with 8051 microcontrollers and develop assembly language programs for various problems

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	3	1	-
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	3	-	2

UNIT-I (12 Hrs)

Introduction to 8086 Microprocessor: 8086 Architecture, Block Diagram, Register Organization, Flag Register, Pin Diagram, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize features of 8086 microprocessor (L2)
- Describe about interrupt structure of 8086 and Interrupt Vector Table (L2)
- Explain the memory segmentation (L2)

UNIT-II (12 Hrs)

8086 Microprocessor Instruction Set and Addressing Modes, Instruction Set of 8086, Assembly Language Programming, Simple programs, Assembler Directives, Procedures and Macros, String manipulation instructions, Simple ALPs.

Learning Outcomes: At the end of this unit, students should be able to

- Understand instruction set of 8086 microprocessor (L1)
- Explain addressing modes of 8086 (L2)
- Develop assembly language programs for various problems (L2)

UNIT-III (12 Hrs)

8086 Interfacing: Programmable Peripheral Interface 8255, Programmable Interval Timer 8253, Programmable Interrupt Controller 8259, Programmable Communication Interface 8251 USART, DMA Controller 8257.

Case Study:

1. 8255 – PPI and its interfacing program– Stepper motor interfacing
2. Interfacing of 7-Segment Display with 8086 microprocessor using 8255.

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate memory & I/O interfacing with 8086 (L2)
- Describe interfacing of 8086 with peripheral devices (L2)

UNIT-IV (10 Hrs)

Intel 8051 Microcontroller, Microprocessor vs Microcontroller, 8051 Microcontroller Architecture, 8051 pin diagram, 8051 Ports, Alternate functions of I/O pins, Memory organization, Internal RAM structure, Stack operation, Counters and Timers, Serial Communication in 8051, interrupts in 8051.

Learning Outcomes: At the end of this unit, students should be able to

- Describe architecture and features of Intel 8051 microcontroller (L2)
- Develop assembly language programs to perform various operations using 8051 (L2)
- Distinguish between microprocessor and a microcontroller (L5)

UNIT-V (12 Hrs)

8051 Instruction Set and Programming: Introduction, Addressing modes of 8051, Instruction set of 8051, Data Transfer Instructions, Data and Bit-Manipulation Instructions, Arithmetic Instructions, simple programs, Interfacing Examples: External memory interfacing in 8051, interfacing of push button switches and LEDS, Interfacing of Relay, Interfacing of seven segment displays, Interfacing of Key board.

Case Study:

1. Interfacing of Seven segment display with 8051 microcontroller
2. Switch interfacing with 8051 microcontroller

3. Relay interfacing with 8051 microcontroller

Learning Outcomes: At the end of this unit, students should be able to

- Understand instruction set of 8051 microcontroller (L1)
- Explain addressing modes of 8051 (L2)
- Develop assembly language programs for various problems (L2)
- Explain the interfacing of 8051 with external devices (L2)

TEXTBOOKS:

1. "Advanced Microprocessors and Peripherals", K M Bhurchandi, A K Ray, McGraw Hill Education, 2017, 3rd edition.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2012, 2nd edition.

REFERENCE BOOKS:

1. "Microprocessor and Interfacing: Programming and Hardware", Douglas V. Hall, McGraw Hill
2. "The 8051 Microcontroller", Kenneth J. Ayala, Cengage Learning, 3rd edition, 2004.
3. "Microprocessors and Interfacing 8086, 8051, 8096 and advanced processors", Senthil Kumar, Saravanan, Jeevanathan, Shah, Oxford University Press, 1st edition, 2012.

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all branches)		L	T	P	C
21A110203			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To know the various types of Market Structures & pricing methods and its strategies.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Analyse the consumer behaviour with regard to their product or services and measure demand of a particular product or services by applying various methods in given situation

CO2: Determine Break Even Point (BEP) of an enterprise Assess the cost behaviour, costs useful for managerial decision making

CO3: Determine the price of a product or services in given market condition

CO4: Analyze the financial position by using different types of ratios and interpret the financial accounting

CO5: Evaluate the investment proposals under payback period, ARR, IRR, NPV & PI methods

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT- I (11 Hrs)

Introduction to Managerial Economics and Demand Analysis: Managerial Economics– Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand- Demand Forecasting- Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Learning Outcomes: At the end of this unit, students should be able to

- Know the nature and scope of Managerial Economics and its importance. (L1)
- Understand the concept of demand and its determinants. (L2)
- Analyse the elasticity and degree of elasticity. (L4)
- Evaluate demand forecasting methods. (L5)
- Design the process of demand estimation for different types of demand. (L6)

UNIT- II (10 Hrs)

Theory of Production and Cost Analysis:

Production Function – Short-run and Long-run Production Function -Isoquants and Iso costs, MRTS –Least cost combination of Inputs, Cobb-Douglas Production Function - Laws of Returns – Internal and External Economies of scale – **Cost & Break-Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA)–Determination of Break-Even Point (Simple Problems)-Managerial significance of Break-Even Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, Input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)
- Develop Profit appropriation for different levels of business activity. (L6)

UNIT- III (11 Hrs)

Introduction to Markets and New Economic Environment:

Market structures Types of Markets-Perfect and Imperfect Competition- Features of Perfect Competition– Monopoly -Monopolistic Competition –Oligopoly-Price-Output Determination-Pricing Methods and Strategies- Forms of Business Organizations - Sole Proprietorship - Partnership – Joint Stock Companies-Public Sector Enterprises - New economic Environment - **Economic Liberalization – Privatization – Globalization.**

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know the production function, input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)

UNIT- IV (10 Hrs)

Capital and Capital Budgeting: Concept of Capital-Significance-Types of Capital-Components of Working Capital - Sources of Short-term and Long-term Capital -Estimating Working capital requirements-**Capital Budgeting**–Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate

of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept of Capital Budgeting and its importance in business (L1)
- Contrast and compare different investment appraisal methods. (L4)
- Analyse the process of selection of investment alternative using different appraisal methods. (L4)
- Evaluate methods of Capital budgeting techniques. (L5)
- Design different investment appraisals and make wise investments. (L6)

UNIT–V (10 Hours)

Introduction to Financial Accounting and Analysis: Financial Accounting – Concept – Emerging need and Importance - Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet (with simple adjustments). ***Financial Analysis*** - Ratios- Liquidity, Leverage, Profitability and Activity Ratios (Simple Problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept and convention and significance of accounting. (L1)
- Apply the fundamental knowledge of accounting while posting the Journal entries. (L3)
- Analyze the process and preparation of Financial Accounts and Financial Ratios. (L4)
- Evaluate the Financial performance of an enterprise by using financial statements. (L5)

TEXTBOOKS:

1. “Managerial Economics”, Varshney & Maheswari, S. Chand, 2013.
2. “Managerial Economics and Financial Analysis”, Aryasri, MGH, 4th edition, 2019

REFERENCE BOOKS:

1. “Managerial economics”, Ahuja HL, S. Chand, 3rd edition, 2013.
2. “Managerial Economics and Financial Analysis”, S. A. Siddiqui and A. S. Siddiqui, New Age International, 2013.
3. “Principles of Business Economics”, Joseph G. Nellis and David Parker, Pearson, 2nd edition, New Delhi.
4. “Managerial Economics in a Global Economy”, Dominick Salvatore, Cengage Learning, 2013.

Course Code	INTERNET OF THINGS LAB		L	T	P	C
21A050410			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Learn the fundamental concepts of IoT and physical computing
- Expose the student to a variety of embedded boards and IoT platforms
- Create an environment of the communication protocols in IoT
- Familiarize the student with application program interfaces for IoT
- Enable students to create simple IoT applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Choose the sensors and actuators for an IoT application
CO2: Select protocols for a specific IoT application
CO3: Utilize the cloud platform and APIs for IoT application
CO4: Experiment with embedded boards for creating IoT prototypes
CO5: Design a solution for a given IoT application

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

EXPERIMENTS LIST:

Week 1

Select any one development board (Eg., Arduino or Raspberry Pi) and control LED using the board.

Week 2

Using the same board as in (1), read data from a sensor. Experiment with both analog and digital sensors.

Week 3

Control any two actuators connected to the development board using Bluetooth.

Week 4

Read data from sensor and send it to a requesting client. (Using socket communication) Note: The client and server should be connected to same local area network.

Week 5
Create any cloud platform account, explore IoT services and register a thing on the platform.

Week 6
Push sensor data to cloud.

Week 7
Control an actuator through cloud.

Week 8
Accesses the data pushed from sensor to cloud and apply any data analytics or visualization services.

Week 9
Create a mobile app to control an actuator.

Week 10
Design an IoT based air pollution control system which monitors the air pollution by measuring carbon monoxide, ammonia, etc and gives alarm or sends message when the pollution level is more than permitted range.

Week 11
Design an IoT based system which measures the physical and chemical properties of the water and displays the measured values.

Week 12
Identify a problem in your local area or college which can be solved by integrating the things you learned and create a prototype to solve it (Mini Project).

Week 13
Design a business model canvas for a digital display

<u>TEXTBOOKS:</u>

1. "Designing the Internet of Things", Adrian McEwen, Hakim Cassimally, Wiley Publications, 2012.
2. "Business Model Generation", Alexander Osterwalder and Yves Pigneur, Wiley, 2011.

REFERENCE BOOKS:

1. "Internet of Things: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti, Universities Press, 2014.
2. "The Internet of Things, Enabling technologies and use cases", Pethuru Raj, Anupama C. Raman, CRC Press.

ONLINE LEARNING RESOURCES:

1. https://www.arduino.cc/
2. https://www.raspberrypi.org/

Course Code	SOFTWARE ENGINEERING & OOAD LAB		L	T	P	C
21A050411	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To Learn and implement the fundamental concepts of software Engineering.
- To explore functional and non-functional requirements through SRS.
- To practice the various design diagrams through appropriate tool.
- To learn to implement various software testing strategies.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the basic concepts of Software Engineering.
CO2: Identify basic issues in software requirements analysis and specification
CO3: Apply the structured, object-oriented analysis and design (SA/SD) technique.
CO4: Design test cases for black box and white box testing.
CO5: Learn and practice project planning activities.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2

SE LAB Experiments List

Week-1

Draw the Work Breakdown Structure for the system to be automated

Week-2

Using COCOMO model estimate effort.

Week-3

a) Calculate effort using FP oriented estimation model.
b) Analyze the Risk related to the project and prepare RMMM pla

Week-4

Develop Time-line chart and project table using PERT or CPM project scheduling methods.

Week-5

Draw E-R diagrams, and DFD for the project.
Design of Test cases based on requirements and design.

Week-6

Test a piece of code which executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.

Week-7

a) Test the percentage of code to be tested by unit test using any code coverage tools
b) Write C/C++/Java/Python program for classifying the various types of coupling.

Week-8

a) Write a C/C++/Java/Python program for classifying the various types of cohesion.
b) Write a C/C++/Java/Python program for object oriented metrics for design proposed Chidamber and kremer . (Popularly called as CK metrics)

OOAD LAB Experiments List

Take three case studies:

- Customer Support System (in the Object-Oriented Analysis & Design with the Unified Process by Satzinger, Jackson & Burd Cengage Learning)
- Point-Of-Sale Terminal (in Larman textbook)
- Library Management System (in the reference book no. 2 i.e., UML toolkit)

Week-9

Familiarization with Rational Rose or *UML

Week-10

For each case study:
a) Identify and analyse events
b) Identify Use cases

Week-11

For each case study:
a) Develop event table
b) Identify & analyse domain classes

Week-12

For each case study:

a) Represent use cases and a domain class diagram using Rational Rose

b) Develop CRUD matrix to represent relationships between use cases and problem domain classes

Course Code	PYTHON PROGRAMMING & DATA SCIENCE LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050307			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- Practical understanding of building different types of models and their evaluation

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Illustrate the use of various data structures. (L3)
CO2: Analyze and manipulate Data using Pandas (L4)
CO3: Creating static, animated, and interactive visualizations using Matplotlib. (L6)
CO4: Understand the implementation procedures for the machine learning algorithms. (L2)
CO5: Apply appropriate data sets to the Machine Learning algorithms (L3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Week 1
Write a program to demonstrate a) Different numeric data types and b) To perform different Arithmetic Operations on numbers in Python.

Week 2
Write a program to create, append, and remove lists in Python.

Week 3
Write a program to demonstrate working with tuples in Python.

Week 4
Write a program to demonstrate working with dictionaries in Python.

Week 5
Write a program to demonstrate a) arrays b) array indexing such as slicing, integer array indexing and Boolean array indexing along with their basic operations in NumPy.

Week 6
Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.

Week 7
Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be the input that to be written to the second file.

Week 8
Write a program to demonstrate Regression analysis.

Week 9
Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Week 10
Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file.

Week 11
Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.

Week 12
Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various “k” values for the quality of clustering.

Week 13
Write a program to build Artificial Neural Network and test the same using appropriate data sets.

TEXTBOOKS:

1. “Deep Learning with Python”, Francois Chollet, Manning Publications Company, 1/e, 2017.
2. “How to Think Like a Computer Scientist: Learning with Python 3”, Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, 3rd edition. URL: http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. “Head First Python a Brain Friendly Guide”, Paul Barry, O’Reilly, 2nd Edition, 2016
4. “Pandas for Everyone Python Data Analysis”, Daniel Y. Chen, Pearson Education, 2019

Course Code	ADVANCED JAVA (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050703			1	0	2	0
Pre-requisite	C Programming & Data Structures	Semester	IV			

COURSE OBJECTIVES:

- The course is designed to provide programming fundamentals using JAVA

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Implement object-oriented programming concepts
CO2: Use and create package and interfaces in a java program.
CO3: Understanding of advance website development tools.
CO4: Use Graphical user interface in java program.
CO5: Creates applets.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	2	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	2	-	-	-	-	-	3	3	-	2

Topics to be covered

1. **Introduction of OOPs:** Summarized overview of Object-Oriented programming Technique.

2. **Class and its objects:** Define class and its object, Constructor, types of Constructors, Default Constructor, method over loading, constructor overloading.

3. **Inheritance:** Define inheritance and its type. Constructor in inheritance, super keyword, method overriding.

4. **Package and interface:** Define Package, how to use it, how to access multiple inheritance using interface, dynamic binding

5. **Variables and Inner Classes:** Types of variables, use of static keyword, Inner classes and its importance.

6. **Exception Handling:** Define Exception, how to handle exception, checked and unchecked exception, custom exception, try, catch and finally keywords.

7. **Java I/O:** How to take input from different devices. Hierarchy of java io class.

8. **String:** String methods, StringBuffer class and its methods.

9. **Multithreading:** Creating thread and running it, Multiple Thread acting on single object, Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread.

10. **applets:** Defining the applet and Applet class, life cycle of applets, Font class, Graphics.

11. **Event Handling:** Define Event and its class, Listener, Adapter, MouseListener, MouseMotionListener, KeyListener.

12. **Swing and its Component Layout:** Swing components and Container, different layout, FlowLayout, BorderLayout, GridLayout.

Experiments List

Week 1
Develop a Java Program to implement the concept OOP

Week 2
Develop a Java Program to implement the concept of Inheritance

Week 3
Develop a Java Program to implement the Packages & Interfaces

Week 4
Develop a Java Program to implement Exception handling

Week 5
Develop a Java Program to implement the concept of Java I/O

Week 6
Develop a Java Program to demonstrate Text File Reading and Writing

Week 7
Develop a Java Program to demonstrate the Strings handling

Week 8
Develop a Java Program to implement the concept Multithreading

Week 9
Develop a Java Program to implement the concept of applet

Week 10
Develop a Java Program to implement Event Handling

Week 11
Develop a Java Program to implement a Simple Calculator

Week 12
Develop a Java Program to demonstrate Swing and its Component Layout

REFERENCE BOOKS:

1. "SCJP Sun Certified Programmer", Kathy Sierra and Bert Bates
2. "The Complete Reference", TMH.
3. "Java SE8 for Programmers", Paul Deitel and Harvey Deitel, Deitel Developer Series, 3rd Edition
4. www.tutorialspoint.com/java/
5. www.javatpoint.com/java-tutorial
6. www.udemy.com/java-tutorial/

Course Code	OPERATING SYSTEMS		L	T	P	C
21A050409	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Understand basic concepts and functions of operating systems
- Understand the processes, threads and scheduling algorithms.
- Provide good insight on various memory management techniques
- Expose the students with different techniques of handling deadlocks
- Explore the concept of file-system and its implementation issues
- Familiarize with the basics of Linux operating system
- Implement various schemes for achieving system protection and security

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Realize how applications interact with the operating system. Analyze the functioning of a kernel in an Operating system. **(K3)**

CO2: Summarize resource management in operating systems. Analyze various scheduling algorithms **(K2)**

CO3: Examine concurrency mechanism in Operating Systems. Apply memory management techniques in design of operating systems **(K4)**

CO4: Understand the functionality of file system. Compare and contrast memory management techniques. **(K2)**

CO5: Understand the deadlock prevention and avoidance. Perform administrative tasks on Linux based systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT – I (8 Hrs)

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

Learning Outcomes: At the end of this unit, students should be able to

- Identify major components of operating systems (L2)

- Understand the types of computing environments (L2)
- Explore several open-source operating systems (L3)
- Recognize operating system services to users, processes and other systems (L3)

UNIT – II (12 Hrs)

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples.
Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers' problem, Readers and writers problem.

Learning Outcomes*:* At the end of this unit, students should be able to

- Understand the importance, features of a process and methods of communication between processes. (L2)
- Improving CPU utilization through multi programming and multithreaded programming (L3)
- Examine several classical synchronization problems (L3)

UNIT – III (12 Hrs)

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

Learning Outcomes*:* At the end of this unit, students should be able to

- Examine the various techniques of allocating memory to processes (L3)
- Summarize how paging works in contemporary computer systems (L3)
- Understanding the benefits of virtual memory systems. (L2)

UNIT – IV (14 Hrs)

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

Learning Outcomes*:* At the end of this unit, students should be able to

- Investigate methods for preventing/avoiding deadlocks (L3)
- Examine file systems and its interface in various operating systems (L2)
- Analyze different disk scheduling algorithms (L3)

UNIT – V (14 Hrs)

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Infer various schemes available for achieving system protection. (L2)
- Acquiring knowledge about various countermeasures to security attacks (L3)
- Outline protection and security in Linux and Microsoft Windows. (L2)

TEXTBOOKS:

1. "Operating System Concepts", Silberschatz A, Galvin P B, and Gagne G, Wiley, 9th edition, 2016.
2. "Modern Operating Systems", Tanenbaum A S, Pearson Education, 3rd edition, 2008.

REFERENCE BOOKS:

1. "Operating Systems Design and Implementation", Tanenbaum A S, Woodhull A S, PHI, 3rd edition, 2006.
2. "Operating Systems A Concept Based Approach", Dhamdhere D MTata McGraw-Hill, 3rd edition, 2012.
3. "Operating Systems -Internals and Design Principles", Stallings W, Pearson Education, 6th edition, 2009
4. "Operating Systems", Nutt G, Pearson Education, 3rd edition, 2004

Course Code	SOFTWARE TESTING (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050414			3	0	0	3
Pre-requisite	Software Engineering & OOAD	Semester	V			

COURSE OBJECTIVES:

- To understand what is testing? and Software development model.
- To describe different approaches to Testing and testing methodologies.
- To demonstrate how to write and execute test plans
- To illustrate the basic concepts of automation testing
- To discuss about Test NG and other important concepts in automation testing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic concepts of testing and SDLC Models. **(K2)**
CO2: Examine STLC and different types of testing and defects. **(K3)**
CO3: Analyze automation testing and its elements and time functions. **(K4)**
CO4: Demonstrate different Popups in automation testing. **(K3)**
CO5: Analyze various Test NG Frameworks. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Manual Testing: Introduction, Error, Defect, Bug, Verification, Validation. Testing: Types of Testing, White box and Black box Testing. Software Development Life Cycle: Introduction to Software Development Life Cycle, Models for SDLC, Metrics for Projects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain types of testing, verification and validation concepts. (L2)
- Describe about Software Development Life Cycle. (L2)

UNIT – II (9 Hrs)

Software Testing Life Cycle: Basic Concepts of Software Testing Life Cycle, Testing Methodologies, Test Plans, Test Cases, Test Executions and Defect Reports. **Defects:** Types of Defects, Defect Life Cycle, Levels vs Builds, Priority and Severity. **Types of Testing:** Functionality Testing, Security Testing, Smoke Testing, Sanity Testing, Adhoc Testing, Exploratory Testing, Load Testing, Stress Testing, Regression Testing, Retesting.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about Software Testing Life Cycle. (L2)

- Examine various types of Testing and Defects. (L3)

UNIT – III (10 Hrs)

Automation Testing: Introduction to Selenium, Components in Selenium, Installation Process, Cross Browser, Parallel Testing, Web Driver Methods and Locators.

Working on the Elements: Links, Dropdown, Radio Buttons, Check Boxes, Web Tables, Actions. **Time Functions:** Implicit, Explicit, Page Load Functions, Scroll Functions.

***Learning Outcomes**:* Student should be able to

- Analyze basic components in selenium (L4)
- Illustrate about different elements and time functions in selenium. (L3)

UNIT – IV (10 Hrs)

Working On Popups: Alerts, Prompts, Confirmation, Working on Frames and Windows, Introduction to Test NG Designs, Annotations in TestNG. Apache POI Jar Files 3.17 for Reading, Writing Excel Files. Page Object Model-Property List.

***Learning Outcomes**:* Student should be able *to*

- Understand the popups in automation testing. (L2)
- Illustrate about TestNG Designs. (L3)

UNIT – V (11 Hrs)

Test NG Frameworks : Framework Designing Structure, Keyword Framework, Data Driven Framework, Linear Framework, Modular Framework, Hybrid Framework. Working on Maven Project – Creating Extent Reports, Basics of Github and Jenkins.

***Learning Outcomes**:* Student should be able to

- Explain various kinds of Test NG Frameworks (L3)
- Describes Marven projects, Github and Jenkins. (L2)

TEXTBOOKS:

1. "Software Testing: Principles and Practices", Srinivasan Desikan, Gopalaswamy Ramesh, 1st Edition, Pearson Education.
2. "Software Testing: Principles and Practices", Naresh Chauhan, 2nd Edition, Oxford University Press

REFERENCE BOOKS:

1. "Software testing techniques", Boris Beizer, Dreamtech, 2nd Edition, 2002.
2. "The craft of software testing", Brian Marick, Pearson Education.
3. "Software Testing", Yogesh Singh, Cambridge
4. "Software Testing", P.C. Jorgensen , 3rd Edition, Aurbach Publications (Dist.by SPD).

Course Code	COMPUTER NETWORKS		L	T	P	C
21A050408	(Common to CSE, CSE-AI, AIML, CSE-IOT)		**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Familiarize with the applications of Internet
- Explore the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Elucidate the design issues for a computer network

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the software and hardware components of a Computer network **(K3)**
CO2: Develop new routing, and congestion control algorithms **(K3)**
CO3: Assess critically the existing routing protocols **(K5)**
CO4: Explain the functionality of each layer of a computer network **(K2)**
CO5: Choose the appropriate transport protocol based on the application requirements **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT – I (8 Hrs)

Computer Networks and the Internet: What is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models, Networks under attack, History of Computer Networking and the Internet

Learning Outcomes: At the end of this unit, students should be able to

- Enumerate the hardware components of a computer network (L1)
- List the layers of a Computer Network (L1)
- Identify the performance metrics of a computer network (L3)

UNIT – II (12 Hrs)

Application Layer Principles of Network Applications, The web and HTTP, File transfer: FTP, Electronic mail in the internet, DNS-The Internet's Directory Service, Peer-to-Peer Applications

Learning Outcomes: At the end of this unit, students should be able to

- Design new applications of a computer network (L6)
- Analyze the application protocols (L4)
- Extend the existing applications (L2)

<u>UNIT – III</u> (14 Hrs)

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, Connectionless Transport: UDP, Principles of Reliable Data transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control

Learning Outcomes: At the end of this unit, students should be able to

- Design Congestion control algorithms (L6)
- Select the appropriate transport protocol for an application (L3)
- Identify the transport layer services (L2)

<u>UNIT – IV</u> (12 Hrs)

The Network Layer: Introduction, Virtual Circuit and Datagram Networks, The Internet Protocol (IP): Forwarding and Addressing in the Internet, Routing Algorithms, Routing in the Internet, Broadcast and Multicast Routing

Learning Outcomes: At the end of this unit, students should be able to

- Compare routing algorithms (L4)
- Design routing algorithms (L6)
- Extend the existing routing protocols (L2)

<u>UNIT – V</u> (12 Hrs)

The Layer: Links, Access Networks, and LANs Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request

Learning Outcomes: At the end of this unit, students should be able to

- Compare medium access protocols (L4)
- Classify the computer networks (L2)
- Design a Data Centre for an organization (L6)

<u>TEXTBOOKS:</u>

1. “Computer Networking: A Top-Down Approach”, James F. Kurose, Keith W. Ross, Pearson, 6th edition, 2019.

REFERENCE BOOKS:

1. "Data communications and Networking", Forouzan, McGraw Hill Publication, 5th Edition.
2. "Computer Networks", Andrew S. Tanenbaum", David J. Wetherall, Pearson, 5th Edition.
3. "Networks for Computer Scientists and Engineers", Youlu Zheng, Shakil Akthar, Oxford Publishers, 2016.

Course Code	SENSORS AND INTERNET OF THINGS		L	T	P	C
21A350401			3	0	0	3
Pre-requisite	Basic Electrical and Electronics Engineering, Applied Physics	Semester	V			

COURSE OBJECTIVES:

- To provide knowledge on Sensor Principles.
- To provide familiarity with different sensors and their application in real life.
- To understand the Basics of IoT, and enabling technologies.
- To design IoT applications using Arduino and Raspberry pi.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate knowledge on the characteristics of sensors. **(K3)**
CO2: Select appropriate sensors for the given application development. **(K2)**
CO3: Understand principles of IoT & Design basic IoT Applications using Arduino. **(K2)**
CO4: Design IoT Applications using Raspberry Pi. **(K5)**
CO5: Perform Data Acquisition and analyse using Cloud and Tkinter. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	-	1	-	-	-	-	-	-	-	2	1
CO2	3	1	3	1	3	-	-	-	2	-	-	3	2	1
CO3	3	3	2	1	-	-	-	-	2	1	-	2	-	2
CO4	3	3	2	1	-		-	-	2	1	-	2	-	2
CO5	-	3	2	2	1	-	-	-	2	2	2	2	2	2

UNIT – I (10 Hrs)

Introduction to Sensors: Sensors, Criteria to choose a Sensor, Generation of Sensors.

Optical Sources and Detectors: ***Optical sources***- LED, Semiconductor lasers, Fiber optic sensors, ***Detectors***- Thermal detectors, Photomultipliers, photoconductive detectors.

Strain, Force, Torque, and Pressure sensors: Strain gages, strain gage beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo-resistive and capacitive pressure sensor, vacuum sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the sensors and its Criteria to choose a Sensor, Generation of Sensors. (L2)
- Understand the different sensors and its principle of operations. (L2)
- Understand the different sensors and its Sources and Detectors. (L2)

UNIT – II (9 Hrs)

TYPES OF SENSORS AND APPLICATIONS

Position, Direction, Displacement, Level sensors, Velocity, Acceleration sensors and

Temperature sensors: Thermo-resistive, thermo-electric, semiconductor and optical, Piezoelectric temperature sensor.

Wearable Sensors: Introduction from fibers to textile sensors - Interlaced network -Textile sensors for physiological state monitoring - Biomechanical sensing –Non-invasive sweat monitoring by textile sensors and other applications. FBG sensor in Intelligent Clothing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the different sensors and its principle of operations. (L2)
- Understand the different sensors Sources and Detectors. (L2)
- Apply the different Wearable Sensors on applications. (L3)

UNIT – III (10 Hrs)

Introduction to Internet of Things: Characteristics of IoT, Design principles of IoT, IoT Architecture and Protocols, Enabling Technologies for IoT, IoT levels and IoT vs M2M.

IoT Design Methodology: Design methodology, Challenges in IoT Design, IoT System Management, IoT Servers.

Basics of Arduino: Introduction to Arduino, Arduino IDE, Basic Commands for Arduino, Connecting LEDs with Arduino, Connecting LCD with Arduino.

Learning Outcomes: At the end of this unit, students should be able to

- Understand about the Principles of Internet of Things (L2)
- Understand about the IoT Design Methodology(L3)
- Understand the basics of Arduino and its IoT Applications using Arduino (L3)

UNIT – IV (8 Hrs)

IOT APPLICATION DEVELOPMENT

Basics of Raspberry Pi: Introduction to Raspberry pi, Installation of NOOBS on SD Card, Installation of Raspbian on SD Card, Terminal Commands, Installation of Libraries on Raspberry Pi, Getting the static IP address of Raspberry Pi, Run a Program on Raspberry Pi, Installing the Remote Desktop Server, Face Recognition using Raspberry Pi, Installation of I2C driver on Raspberry Pi, SPI (serial peripheral interface) with Raspberry Pi, Programming a Raspberry Pi, Play with LED and Raspberry Pi, Reading the digital input, Reading an edge triggered input, Interfacing of Relay with Raspberry Pi, Interfacing of Relay with Raspberry Pi, Interfacing of LCD with Raspberry Pi, Interfacing LCD with Raspberry Pi in I2C mode, Interfacing of DHT11 sensor with Raspberry Pi

Interfacing of ultrasonic sensor with Raspberry Pi, Interfacing of camera with Raspberry pi.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the architecture and basic concepts of Raspberry Pi((L2)
- Apply the different devices and sensors Interfacing with Raspberry Pi((L3)
- Analyse IoT Applications using Raspberry Pi. (L4)

UNIT – V (8 Hrs)

DATA ACQUISTION AND CLOUD

Data Acquisition with Python and Tkinter: Basics-CSV file, Storing Arduino data with CSV file, plotting random numbers using matplotlib, plotting real-time from Arduino, Integrating the plots in the Tkinter window.

Connecting to the Cloud: Smart IoT Systems, DHT11 Data Logger with ThingSpeak Server, Ultrasonic Sensor Data Logger with ThingSpeak Server, Air Quality Monitoring System and Data Logger with ThingSpeak Server, Landslide Detection and Disaster Management System.

Learning Outcomes*:* At the end of this unit, students should be able to

- Apply the Data Acquisition with Python and Tkinter ((L3)
- Analyse the Connecting to the Cloud (L4)
- Evaluate the IoT Applications using Raspberry Pi. (L5)

TEXTBOOKS:

1. "Handbook of Modern Sensors: Physical, Designs, and Applications", J. Fraden, AIP Press, Springer, 4th Edition, 2010.
2. "Internet of Things with Raspberry Pi and Arduino", Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, CRC Press, 2019.

REFERENCE BOOKS:

1. "Sensors and Transducers", D. Patranabis, PHI Publication, New Delhi,2003.
2. "From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence", Jan Holler and Vlasios Tsiatsis, Elsevier Ltd., 2014.
3. "IoT Fundamentals: Networking Technologies, Protocols,and Use Cases for the Internet of Things", David Hanes and Gonzalo Salgueiro, Cisco Press, 2017

ONLINE LEARNING RESOURCES:

1. https://www.guru99.com/iot-tutorial.html
2. https://developer.ibm.com/technologies/iot/tutorials/

Course Code	SAP (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050417			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To bridge the gap between the Academics and Industries
- To create job ready manpower resource pool with the skills of SAP
- To enhance employability by meeting the skill requirement of industry to address ever changing business needs.
- To build knowledge based Economy with cost effective program for World's best IT Company
- To understand industry best practices supported by SAP ERP – "Be future ready"

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the basic concepts of ERP (Enterprise Resource Planning) & SAP (Systems Applications and Products in Data Processing) **(K3)**

CO2: Analyze the SAP Net-Weaver Architecture for designing ABAP (Advanced Business Application Programming) **(K4)**

CO3: Categorize the various components of SAP & Client Administration **(K4)**

CO4: Solve the general administration and monitoring problems **(K3)**

CO5: Cconnect new versions of SAP like SAP HANA for Cloud Data. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	2	1	-	-	-	-	-	-	-	-	-	2
CO2	2	1	3	3	1	-	-	-	-	-	-	-	-	2
CO3	2	1	3	2	-	-	-	-	-	-	-	-	-	2
CO4	1	-	2	2	1	-	-	-	-	-	-	-	2	-
CO5	2	1	3	3	2	-	-	-	-	-	-	-	2	-

UNIT – I (9 Hrs)

ERP Introduction: ERP and its background, Different types of ERPs, Evolution of SAP, Different versions of SAP, New dimensional components of SAP, Modules of each SAP component.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basics concepts of ERP (L2)
- Understand the evolution and versions of SAP (L2)
- Analyse the various modules of SAP (L3)

UNIT-II (9 Hrs)

SAP Net-Weaver Architecture: NW Introduction, Components of NW & Core Architecture, Application servers, Central Instance, Dialog instance, ABAP and Java Stacks, Message servers, Dispatchers, WPs and the types, System Landscape

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the different components of NW (L3)
- Analyse the architecture of Net-Weaver (L3)
- Understand the ABAP and creating servers (L2)

UNIT – III (9 Hrs)

SAP Components: Core Component and functionality, Modules of SAP components, Roles in SAP application, Basis introduction to SAP technical work flow.

Client Administration: Client Concept, Create clients, Client Export/Import, Copy Logs, Monitoring of Client Copy

Learning Outcomes: At the end of this unit, students should be able to

Understand the components of SAP & Applications (L2)

- Analyse the workflow of SAP (L3)
- Plan the Client Administration like importing and exporting data (L5)

UNIT – IV (9 Hrs)

General Administration: Daily, weekly and monthly monitoring the system health, T-Codes related to System monitoring, Background Jobs administration, Spool architecture and administration, Performance tuning methods and implantation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the General monitoring and administration methods (L2)
- Analyse the spool architecture and administration (L3)
- Applying the performance monitoring methods (L3)

UNIT – V (8 Hrs)

Database administration: Oracle Database concepts, Monitoring Table spaces, SAPDBA/BR Tools, DB Activities and T-Codes, SAP HANA.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the database administration methods (L2)
- Analyse the SAPDBA Tools (L3)
- Comparing latest versions of SAP like SAP HANA (L2)

TEXTBOOKS:

1. "The Beginner's Guide to sap", Peter Moxon, SAPPROUK Limited
2. "SAP HANA: An Introduction", Bjarne Berg, Penny Silvia, Galilio Press, 3rd Edition

REFERENCE BOOKS:

1. "SAP HANA 2.0: An Introduction", Denys Van Kempen
2. "SAP HANA 2.0 Administration", Bert Vanstechelman

3. "ABAP Development for SAP HANA (SAP PRESS)", Mohsin Ahmed, Sumit Naik, 1st Edition

Course Code	MOBILE COMPUTING		L	T	P	C
21A050418	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Computer Networks	Semester	V			

COURSE OBJECTIVES:

- To understand mobile ad hoc networks, design and implementation issues, and available solutions
- To acquire knowledge of sensor networks and their characteristics

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the implementation issues in LANS and PANS of wireless networks.**(K3)**

CO2: Organizing and differentiating various MAC Protocols usage in Adhoc Wireless Networks. **(K4)**

CO3: Analyse Various Routing and Security Protocols in Wireless Networks.**(K4)**

CO4: Classification of QOS and Energy management in Wireless Networks.**(K4)**

CO5: Comparing various Protocols in wireless Sensor Networks and their characteristics. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	-	2
CO4	3	3	3	2	1	-	-	-	-	-	-	-	2	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Wireless LANS and PANS: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.

Wireless Internet: Wireless Internet, Mobile IP, TCP in Wireless Domain, WAP, Optimizing Web over Wireless.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish LANs, WLANs and PANS. (L5)
- Examine about IEEE 802 Standards, Hiperlans and Bluetooth. (L3)

UNIT – II (9 Hrs)

AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, AD Hoc Wireless Internet.

MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention –

Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Illustrate about AD HOC Wireless Networks. (L3)
- Analyse MAC Protocols for Ad Hoc Wireless Networks. (L4)

UNIT – III (9 Hrs)

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding, Flooding: Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

Transport Layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks, Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand basic terminology of Routing Protocols. (L2)
- Explain different classifications of Routing Protocols. (L4)
- Illustrate various Transport Layer and Security Protocols. (L4)

UNIT – IV (9 Hrs)

Quality of Service: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks.

Energy Management: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the Quality of Service in Ad Hoc Wireless Networks. (L2)
- Explain about Energy Management concepts in Wireless Networks. (L6)

UNIT – V (8 Hrs)

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

Learning Outcomes: At the end of this unit, students should be able to

- Describe Wireless Sensor Networks. (L2)
- Explain various MAC Protocols for Wireless Sensor Networks. (L4)

TEXTBOOKS:

1. "Ad Hoc Wireless Networks: Architectures and Protocols", C. Siva Ram Murthy and B. S. Manoj, PHI, 2004.
2. "Wireless Ad-hoc and Sensor Networks: Protocols, Performance and Control", Jagannathan Sarangapani, CRC Press.

REFERENCE BOOKS:

1. "Ad hoc Mobile Wireless Networks", Subir Kumar sarkar, T G Basvaraju, C Puttamadappa, Auerbach Publications, 2012.
2. "Wireless Sensor Networks", C. S. Raghavendra, Krishna M. Sivalingam, Springer, 2004.
3. "Ad-Hoc Mobile Wireless Networks: Protocols & Systems", C.K. Toh, Pearson Education.

Course Code	**SOFTWARE TESTING LAB**		**L**	**T**	**P**	**C**
21A050419	(Common to CSE, CSE-AI, AIML, CSE-IOT)		**0**	**0**	**3**	**1.5**
Pre-requisite	Object Oriented Programming through Java	Semester	V			

COURSE OBJECTIVES:

- To understand the fundamentals for various testing methodologies.
- To describe the principles and procedures for designing test cases.
- To explore debugging methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the basic testing procedures. **(K2)**

CO2: Formulate test cases and test suites **(K6)**

CO3: Choose Selenium tools to perform testing **(K3)**

CO4: Construct and test simple programs. **(K6)**

CO5: Describe bug tracking **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	-	-	-	-	3	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	2	-	-	-	-	-	-	2	1
CO4	3	-	2	-	-	-	-	-	-	-	-	-	2	-
CO5	-	3	3	-	-	2	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

MANUAL TESTING: (USING C LANGUAGE)

1. Write a ‘C’ program to demonstrate the working of the following constructs:
a). do…while
b). while
c). if …else
d). switch
e). for Loops in C language.
2. A program written in c language for matrix multiplication fails “Introspect the causes for its failure and write down the possible reasons for its failure”.
3. Take any system (e.g. ATM system) and study its system specifications and report the various bugs.
4. Write the test cases for any known application (e.g. Banking application)
5. Create a test plan document for any application (e.g. Library Management System).

AUTOMATION TESTING : (using Selenium)

1. Write a script to open google.com and verify that title is Google and also verify that it is redirected to google.co.in.
2. Write a script to open google.co.in using chrome browser (ChromeDriver).
3. Write a script to open google.co.in using internet explorer (InternetExplorerDriver).
4. Write a script to login Next Generation Automation.
5. Write a script to close all the browsers without using quit() method.
6. Write a script to test the cookie creation.
7. Write a script to test the Gmail Login & Logout procedure.
8. Write a script to test the Facebook Account Creation.
9. Write a script to test the Google Cache Selection.
10. Write a script to test the Gmail Composing Dynamically.

TEXTBOOKS:

1. "Software Testing: Principles and Practices", Srinivasan Desikan, Gopalaswamy Ramesh, 1st Edition, Pearson Education.
2. "Software Testing: Principles and Practices", Naresh Chauhan, 2nd Edition, Oxford University Press
3. "Java Complete Reference", Herb Schildt, 9th Edition, Oracle press.

Course Code	COMPUTER NETWORKS & OPERATING SYSTEMS LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050412			0	0	3	1.5
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand the working of character and bit stuffing
- To understand the Dijkstra's algorithm and its performance
- To analyze the performance of DES encryption algorithms
- To understand CPU scheduling algorithms and page replacement algorithms

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand how data is transmitted and checking of errors. **(K2)**

CO2: Understand Inter process communication including shared memory, pipes and messages **(K2)**

CO3: Simulate CPU Scheduling Algorithms. (FCFS, RR, SJF, Priority, Multilevel Queuing) **(K6)**

CO4: Simulate Banker's Algorithm for Deadlock Avoidance, Prevention Program for FIFO, LRU, and OPTIMAL page replacement algorithm. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2

PART-A

Week 1

Implement the data link layer framing methods such as character, character stuffing and bit stuffing.

Week 2

Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.

Week 3

Implement Dijkstra 's algorithm to compute the Shortest path thru a graph.

Week 4

a) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

b) Take an example subnet of hosts. Obtain broadcast tree for it.

Week 5

a) Take a 64-bit playing text and encrypt the same using DES algorithm.
b) Write a program to break the above DES coding

Week 6

Using RSA algorithm Encrypt a text data and Decrypt the same.

PART-B

Week7

Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority

Week 8

Simulate all file allocation strategies a) Sequential b) Indexed c) Linked

Week 9

Simulate MVT and MFT

Week 10

Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG

Week 11

a) Simulate Bankers Algorithm for Dead Lock Avoidance
b) Simulate Bankers Algorithm for Dead Lock Prevention

Week 12

Simulate all page replacement algorithms a) FIFO b) LRU c) LFU Etc. …

Week 13

a) Simulate Paging Technique of memory management.
b) Experiments on fork, shared memory and semaphores

TEXTBOOKS:

1. "Introduction to Data Communications and Networking", Behrouz Forouzan, Tata McGraw Hill, 2015, 5th Edition.

2. "Data and Computer Communications", Stallings, PHI, 2015, 10th Edition.

REFERENCE BOOKS:

1. "Data Communication", William Schewber, McGraw Hill, 1987.
2. "Computer Networks", Tanenbaum, PHI, 5th Edition, 2011.
3. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, John Wiley, Eight Edition
4. "Operating Systems: Internals and Design Principles", Stallings, Pearson Education, Sixth Edition, 2009.
5. "Modern Operating Systems", Andrew S Tanenbaum, PHI, Second Edition.

ONLINE LEARNING RESOURCES:

1. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
2. http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm
3. http://iit.qau.edu.pk/books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
4. http://www.networkdictionary.com/protocols/osimodel.php

Course Code	PROGRAMMING IN EMBEDDED C		L	T	P	C
21A350701			1	0	2	2
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To impart technical skills to the students right from the basics to advanced level, such that, by the end of the program the student is developed as the finished product, ready to join the industry.
- To describe what an embedded system is, what makes them different, and what embedded systems designers need to know to develop embedded systems
- To provide the student with a life cycle view for designing multi-objective, multi-discipline embedded systems
- To impart a solid understanding of the role of embedded systems and embedded systems design and development in modern day's technology-enabled society
- To understand the role of embedded systems in the context of complex engineering systems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Transfer the executable code to the embedded hardware and test the system **(K)**

CO2: Describe Keil hardware simulator will allow you to simulate suitable hardware for use with the program. **(K)**

CO3: Describe how to use an object-oriented style of programming with C programs. **(K)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2														
CO3														

UNIT – I

Programming embedded systems in C: Introduction, what is an embedded system? Which processor should you use? Which programming language should you use? Which operating system should you use?, How do you develop embedded software?.

Hello, embedded world: Introduction, Installing the Keil software and loading the project, Configuring the simulator, Building the target, Running the simulation, Dissecting the program, aside: Building the hardware.

UNIT – II

Reading switches: Introduction Basic techniques for reading from port pins, Example: Reading and writing bytes, Example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, dealing with switch bounce, Example: Reading switch inputs (basic code), Example: Counting goats.

UNIT – III

Adding structure to your code: Introduction, Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: Restructuring the 'Hello Embedded World' Example: Restructuring the goat-counting example, Further examples.

UNIT – IV

Meeting real-time constraints: The need for 'timeout' mechanisms, creating loop timeouts, Example: Testing loop timeouts, Example: A more reliable switch interface, creating hardware timeouts, Example: Testing a hardware timeout.

Multi-state systems and function sequences: Introduction, implementing a Multi-State (Timed) system, Example: Traffic light sequencing, Example: Animatronic dinosaur, implementing a Multi-State (Input/Timed) system, Example: Controller for a washing machine.

UNIT – V

Using the serial interface: Introduction, what is RS-232? Does RS-232 still matter? The basic RS-232 protocol, Asynchronous data transmission and baud rates, Flow control, the software architecture, Using the on-chip UART for RS-232 communications, Memory requirements, Example: Displaying elapsed time on a PC, The Serial-Menu architecture, Example: Data acquisition, Example: Remote-control robot.

LIST OF EXPERIMENTS:

1. Program to transmit message from microcontroller to PC serially using RS232
2. Program to interface Elevator.
3. Program to interface keypad. Whenever a key is pressed, it should be displayed on LCD
4. Program to receive a message from PC to microcontroller serially using RS232
5. Program to interface a switch and a buzzer to two different pins of a port such that the buzzer should sound as long as the switch is pressed.
6. Interrupt programming through GPIOs
7. PWM generation using Timer on MSP430 GPIO
8. Interfacing potentiometer with MSP430
9. a) Interfacing DC motor. b) Interfacing Relay. c) Interfacing Servo d) Interfacing Stepper motor.
10. Write a random number generation function using assembly language. Call this function from a C program to produce a series of random numbers and save them in the memory
11. Design a Water level controller using Microcontroller
12. Design a Bio metric Attendance System
13. Design a Fingerprint based Security system

TEXTBOOKS:

1. "Embedded Systems", Michael J. Pont, Pearson Education, 2015

REFERENCE BOOKS:

1. “Embedded C Programming: Techniques and Applications of C and PIC MCUS”, Mark Siegesmund, 2014.
2. “Embedded C Programming and the Atmel AVR”, Richard H. Barnett, Sarah Cox, Larry O'Cull, 2006.

ONLINE LEARNING RESOURCES:

1. https://www.javatpoint.com/embedded-system-c-programming
2. https://www.udemy.com/course/embedded-system-programming-on-arm-cortex-m3m4/

Course Code	UNIVERSAL HUMAN VALUES (Common to all branches)		L	T	P	C
21A000003			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the significance and need of values in the society. **(K2)**

CO2: Understand the meaning of Harmony in the Self the Co-existence of Self and Body. **(K2)**

CO3: Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society **(K2)**

CO4: Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. **(K3)**

CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-

UNIT – I (9 Hrs)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the significance and need of values in the society. (L2)

UNIT – II (9 Hrs)

Understanding Harmony in the Human Being - Harmony in Myself: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programs to ensure self-regulation and Health.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the meaning of Harmony in the Self the Co-existence of Self and Body. (L2)
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. (L2)

UNIT – III (9 Hrs)

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order

Learning Outcomes: At the end of this unit, students should be able to

- Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society (L2)

UNIT – IV (9 Hrs)

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at all Levels, and the Holistic Perception of Harmony in Existence.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. (L3)

UNIT – V (9 Hrs)

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Learning Outcomes: At the end of this unit, students should be able to

- Identify the scope and characteristics of people friendly and eco-friendly production systems. (L2)
- Develop appropriate technologies and management patterns for above production systems. (L3)

- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. (L3)

TEXTBOOKS:

1. "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

REFERENCE BOOKS:

1. "Jeevan Vidya: Ek Parichaya", A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. "Human Values", A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. "The Story of My Experiments with Truth", Mohandas Karamchand Gandhi
5. "Small is Beautiful", E. FSchumacher.
6. "Slow is Beautiful", Cecile Andrews
7. "Economy of Permanence", J C Kumarappa
8. "Bharat Mein Angreji Raj", Pandit Sunderlal
9. "Rediscovering India", Dharampal,
10. "Hind Swaraj or Indian Home Rule", Mohandas K. Gandhi,
11. "India Wins Freedom", Maulana Abdul Kalam Azad
12. "Vivekananda", Romain Rolland (English)
13. "Gandhi", Romain Rolland (English)

ONLINE LEARNING RESOURCES:

1. http://www.uhv.org.in/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://www.studocu.com/in/document/dr-apj-abdul-kalam-technical-university/universal-human-valuestechnical-communication/uhv-best-notes/31376289

Course Code	ARTIFICIAL INTELLIGENCE		L	T	P	C
21A050421	(Common to CSE, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To define Artificial Intelligence and establish the cultural background for study
- To understand various learning algorithms
- To explore the searching and optimization techniques for problem solving
- To provide basic knowledge on Natural Language Processing and Robotics

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply searching techniques for solving a problem **(K4)**
CO2: Design Intelligent Agents **(K3)**
CO3: Develop Natural Language Interface for Machines **(K3)**
CO4: Design mini robots **(K3)**
CO5: Summarize past, present and future of Artificial Intelligence **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	1	-	-	-	-	-	-	2
CO2	3	3	3	2	1	1	-	-	-	-	-	-	-	2
CO3	2	3	3	2	1	-	-	-	-	-	-	-	2	2
CO4	3	3	2	2	1	-	-	-	-	-	-	-	2	-
CO5	3	3	2	2	1	-	-	-	-	-	-	-	2	-

UNIT – I (9Hrs)

Introduction: What is AI, Foundations of AI, History of AI, The State of Art. **Intelligent agents**: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the history of Artificial Intelligence (L2)
- Analyse the nature of Agent behaviour and its environment (L3)
- Recognize rationality of agent working (L2)
- Identify the requirement to implement agent structure (L2)

UNIT – II (10 Hrs)

Solving problems by searching: Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, **Beyond Classical Search:** Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the searching methodology using agents (L2)
- Differentiate informed and uninformed search strategies (L3)
- Apply search strategy in non-deterministic environment (L4)
- Use agents to solve complex searching problems (L3)

UNIT – III (9 Hrs)

Reinforcement learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL **Natural language processing**: Language Models, Text Classification, Information Retrieval, Information Extraction.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Examine how an agent can learn from success and failure, reward and punishment (L5)
- Compare and apply active and passive types of reinforcement learning (L3)
- Apply Natural Language Processing in Text, Information retrieval and Extraction systems (L4)

UNIT – IV (9 Hrs)

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition **Perception**: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Use natural language for augmenting grammars, speech recognition and syntactic analysis (L5)
- Identify the object, image using perception concepts (L3)
- Develop programs that translate from one language to another, or recognize spoken words. (L6)
- Recognize the structural information using Vision concepts (L3)

UNIT – V (8 Hrs)

Robotics: Introduction, Robot Hardware, Robotic Perception, planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains **Philosophical Foundations**: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Robotics architecture and its working in real world applications (L2)
- Apply robotics operations in different application domains (L5)
- List the main philosophical issues in AI. (L1)
- Analyse various variations in strong and weak AI (L4)

TEXTBOOKS:

1. "Artificial Intelligence A Modern Approach", Stuart J. Russell, Peter Norvig, Pearson Education, 3rd Edition, 2019.

REFERENCE BOOKS:

1. "Artificial intelligence: a new synthesis", Nilsson, Nils J., and Nils Johan Nilsson, Morgan Kaufmann, 1998.
2. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence", Johnson, Benny G., Fred Phillips, and Linda G. Chase, Journal of Accounting Education, 2009

Course Code	MOBILE APPLICATION DEVELOPMENT		L	T	P	C
21A050422	(Common to CSE, CSE-AI, AIML, CSE-IOT)		**3**	**0**	**0**	**3**
Pre-requisite	Object Oriented Programming through Java	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of android operating systems.
- To illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify mobile application development software development tools. **(K3)**
CO2: Analyse various widgets in mobile applications**. (K3)**
CO3: Compare various layouts in mobile application design. **(K3)**
CO4: Utilize multimedia, camera and Location based services in Android App. **(K3)**
CO5: Build mobile application with dialogs and Fragments and Design and develop menus with database in mobile applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	3	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3

UNIT – I (9 Hrs)

Introduction to Android: The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Android architecture. (L3)
- Summarize the various features for Android (L2)

UNIT – II (9 Hrs)

Basic Widgets: Understanding the Role of Android Application Components, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages

Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the basic Widgets (L4)
- Discover the Need for Event Handling in different Mobile Applications (L3)
- Choose the controls for the mobile Applications (L3)

<u>UNIT – III</u> (9 Hrs)

Building Blocks for Android Application Design: Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation.

Utilizing Resources and Media: Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video, Displaying Progress with Progress Bar, Using Assets.

Learning Outcomes: At the end of this unit, students should be able to

- Choose the building blocks for Android Application Design (L3)
- Select the resources and media for the mobile Applications (L3)
- Illustrating the mobile design (L4)

<u>UNIT – IV</u> (9 Hrs)

Using Selection widgets and Debugging: Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control, Using the Debugging Tool: Dalvik Debug Monitor Service(DDMS), Debugging Application, Using the Debug Perspective.

Displaying And Fetching Information Using Dialogs and Fragments: What Are Dialogs?, Selecting the Date and Time in One Application, Fragments, Creating Fragments with java Code, Creating Special Fragments

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the debugging process (L3)
- Choose the selection widgets for mobile applications (L3)
- Illustrate Dialogs and Fragments (L4)

<u>UNIT – V</u> (9 Hrs)

Building Menus and Storing Data: Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar

Using Databases: Using the SQLite Open Helper class, Accessing Databases with the ADB, Creating a Data Entry Form,

Communicating with SMS and Emails: Understanding Broadcast Receivers, Using the Notification System, Sending SMS Messages with Java Code, Receiving SMS Messages, Sending Email, Working With Telephony Manager.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Create Menus and Storing Data (L6)
- Analyse Databases for mobile applications (L4)
- Analyse Communications with SMS and Emails (L4)

TEXTBOOKS:

1. "Android Programming", B.M Harwani, Pearson Education, 2013

REFERENCE BOOKS:

1. "Android application Development for Java Programmers", James C Sheusi, Cengage Learning
2. "Android In Action", W. Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz., Dreamtech.
3. "Professional Android 4 applications development", Reto Meier, Wiley India, 2012.
4. "Beginning Android 4 applications development", Wei Meng Lee, Wiley India,2013
5. "Beginning Android Development: Create Your Own Android", PawPrints Learning Technologies, Apps Today, 2014.
6. "Android Programming: Pushing the Limits", Erik Hellman, John Wiley and sons ltd, 2014.
7. "Introduction to Android Application Development", Joseph Annuzzi, Jr, Lauren Darcey, Addison-Wesley, 4th Edition.

Course Code	CYBER PHYSICAL SYSTEMS		L	T	P	C
21A350402			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To introduce modelling of CPS
- To develop the ability to analyze and simulate CPS systems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply modeling and associated tools for Hybrid system. **(K3)**

CO2: Analyze CPS by with holistic models of cyber and physical components.**(K4)**

CO3: Understand CPS design, modeling, and analysis. **(K2)**

CO4: Compare architectural design trade-offs in CPS. **(K4)**

CO5: Understand methods for verification and validation of CPS such as simulation, testing, model checking, etc. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	3

UNIT – I (9 Hrs)

Medical Cyber-physical Systems: Introduction and Motivation, System Description and Operational Scenarios, Key Design and Quality Attributes, Practitioner's Implications.

Energy Cyber-Physical Systems: Introduction and Motivation, System Description and Operational Scenarios, Key Design and Quality Attributes, Cyber Paradigm for Sustainable SEES, Practitioner's Implications.

Learning Outcomes: At the end of this unit, students should be able to

- Gain basic familiarity with modelling for Cyber Physical Systems (L3)
- Distinguish Medical Cyber-physical Systems and Energy Cyber-Physical Systems(L4)

UNIT – II (8 Hrs)

Cyber-Physical Systems Built on Wireless Sensor Networks: Introduction and motivation.

System Description and Operational Scenarios: MAC, Routing, Node Localization, Clock Synchronization, and Power Management.

Key Design and Quality Attributes: Physically Aware, Real-Time Aware, Runtime validation aware, Security aware

Learning Outcomes: At the end of this unit, students should be able to

- Learn how to develop software for a CPS on WSN using a model-based development approach. (L3)
- Learn Cyber Physical systems description and operational scenarios. (L3)

UNIT – III (8 Hrs)

Logical Correctness for Hybrid Systems: Introduction and motivation, Basic techniques: Discrete Verification. Advanced techniques: Real-Time Verification, Hybrid verification.

Security of Cyber-Physical Systems - Introduction and motivation, Basic techniques: Cyber security requirements, Attack model, Counter measures. Advanced techniques: System theoretic approaches

Learning Outcomes: At the end of this unit, students should be able to

- Learn various basic and advanced verification techniques to test CPS (L3)
- Gain knowledge to provide security for Cyber Physical Systems. (L3)

UNIT – IV (9 Hrs)

Synchronization in Distributed Cyber-Physical Systems: Introduction and motivation, Basic techniques: Formal software engineering, distributes consensus algorithms, Synchronous lockstep executions, Time-triggered architecture.

Advanced techniques: Physically asynchronous, Logically synchronous systems.

Real-Time Scheduling for Cyber-Physical Systems: Introduction and motivation, Basic techniques – Scheduling with fixed Timing Parameters, Memory Effects. Advanced techniques – Multiprocessor / Multicore scheduling, Accommodating variability and uncertainty.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish Physically asynchronous vs Logically synchronous systems. (L4)
- Learn about Real-Time Scheduling for Cyber-Physical Systems. (L3)

UNIT – V (11 Hrs)

Model Integration in Cyber-Physical Systems: Introduction and Motivation, Basic Techniques: Causality, Semantic domains for time, Interaction models for computational processes, Semantic of CPS DSMLs. Advanced Techniques: For Spec, The syntax of CyPhyML, Formalization of semantics, Formalization of Language Integration.

Learning Outcomes: At the end of this unit, students should be able to

- Gain knowledge on Model Integration in Cyber-Physical Systems. (L3)
- Know the syntax and semantics of CyPhyML and Formalization of Language Integration. (L3)

TEXTBOOKS:

1. "Cyber Physical Systems", Raj Rajkumar, Dionisio de Niz, Mark Klein, 2017

REFERENCE BOOKS:

1. "Introduction to Embedded Systems: A Cyber-Physical Systems Approach", E. A. Lee and S. A. Seshia, 2011

ONLINE LEARNING RESOURCES:

1. Introduction to Cyber-Physical Systems (CPS): An Overview (acodez.in)

Course Code	WIRELESS AND ADHOC NETWORKS		L	T	P	C
21A350403			3	1	0	3
Pre-requisite	Computer Networks	Semester	VI			

COURSE OBJECTIVES:

- To introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- To demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compare various Adhoc Wireless Sensor Networks. **(K4)**
CO2: Analyze various MAC Protocols for Adhoc Wireless Sensor Networks **(K4)**
CO3: Design Routing Protocols for Adhoc Wireless Sensor Networks depending on Network. **(K3)**
CO4: Design Transport Protocols suitable for Adhoc Wireless Sensor Networks. **(K3)**
CO5: Analyze various security issues in Adhoc Wireless Sensor Networks. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

ADHOC WIRELESS NETWORKS AND ITS APPLICATIONS: IEEE 802 Networking Standard. Fundamentals of WLANs, IEEE 802.11 standard. What is Wireless Internet? Mobile IP, Cellular and Ad-hoc Wireless Networks, Applications of Adhoc Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet.

Learning Outcomes: At the end of this unit, students should be able to

- Explain different wireless networks. (L2)
- Examine wireless LAN Standard IEEE 802.11.(L4)

UNIT – II (9 Hrs)

MAC PROTOCOLS IN ADHOC WIRELESS NETWORKS: Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that used Directional Antennas, Other MAC Protocols.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the limitations of existing MAC protocols when applied to adhoc networks. (L3)
- Analyse the existing MAC Protocols for Adhoc networks. (L3)

UNIT – III (10 Hrs)

ROUTING PROTOCOLS IN ADHOC WIRELESS NETWORKS: Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table-Driven Routing Protocols, On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols, Power-Aware Routing Protocols.

Learning Outcomes: At the end of this unit, students should be able to

- Compare different routing protocols. (L2)
- Choose the routing protocol based on network characteristics. (L5)

UNIT – IV (9 Hrs)

TRANSPORT PROTOCOL IN ADHOC WIRELESS NETWORKS: Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions. TCP over Ad Hoc Wireless Networks, Other Transport Layer Protocols for Ad Hoc Wireless Networks

Learning Outcomes: At the end of this unit, students should be able to

- Interpret the issues in designing a multicast Routing Algorithms (L2)
- Propose new Transport protocols for adhoc networks (L6)

UNIT – V (8 Hrs)

SECURITY AND WIRELESS SENSOR NETWORKS: Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks. Wireless Sensor Networks- Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other issues.

Learning Outcomes: At the end of this unit, students should be able to

- Define the sensor networks. (L1)

TEXTBOOKS:

1. “Ad hoc wireless networks: Architectures and protocols”, Murthy, C. Siva Ram, and B. S. Manoj, Pearson Education India, 2004.

REFERENCE BOOKS:

1. “Ad Hoc & Sensor Networks: Theory and Applications”, Carlos De Morais Cordeiro, Dharma Prakash Agrawal, World Scientific Publishing Company, 2006

2. "Wireless Sensor Networks", Feng Zhao and Leonides Guibas, Elsevier Publication, 2002.
3. "Protocols and Architectures for Wireless Sensor Networks", Holger Karl and Andreas Willig, Wiley, 2005

ONLINE LEARNING RESOURCES:

1. https://en.wikipedia.org/wiki/Wireless_ad_hoc_network
2. https://study.com/academy/lesson/what-is-an-ad-hoc-wireless-network-explanation-examples.html

Course Code	REAL TIME SYSTEMS (Common to CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A310413			3	0	0	3
Pre-requisite	Operating Systems	Semester	VII			

COURSE OBJECTIVES:

- To develop an understanding of various Real Time systems Application
- To obtain a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
- To get in-depth hands-on experience in designing and developing a real operational system

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand concepts of Real-Time systems and modeling. **(K2)**
CO2: Recognize the characteristics of a real-time system. **(K4)**
CO3: Understand and develop document on an architectural design of a real-time system **(K3)**
CO4: Develop and document Task scheduling, resource management, real-time operating systems and fault tolerant applications of Real-Time Systems. **(K4)**
CO5: Understand features of RTOS and using different data bases related to RTOS **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the dead line, Timing constraint (L3)
- Differentiation between Hard vs Soft Real Time Systems (L3)
- Understand the temporal parameters (L4)
- Implement Periodic Task Model (L2)

UNIT – II (8 Hrs)

Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Apply different types of Approaches for Real time Scheduling (L3)
- Understand the different algorithms for Real time Scheduling (L3)
- Differentiate between Offline Versus Online Scheduling (L3)

UNIT – III (9 Hrs)

Resources Sharing: Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of Resource Sharing (L2)
- Apply different protocols for accessing the resources (L3)
- Control the Concurrent Accesses to Data Objects (L5)

UNIT – IV (8 Hrs)

Real Time Communication: Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Soft and Hard RT Communication systems (L6)
- Design Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols. (L6)
- Use Internet and Resource Reservation Protocols (L3)

UNIT – V (9 Hrs)

Real Time Operating Systems and Databases: Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.

Learning Outcomes: At the end of this unit, students should be able to

- Use UNIX as RTOS(L2)
- Understand the Characteristic of Temporal data(L6)
- Apply the different data bases in Real Time Systems. (L6)

TEXTBOOKS:

1. "Real Time Systems", Jane W. S. Liu, Pearson Education Publication

REFERENCE BOOKS:

1. "Real Time Systems", Mall Rajib, Pearson Education
2. "Real-Time Systems: Scheduling, Analysis, and Verification", Albert M. K. Cheng, Wiley.

Course Code	EMBEDDED SYSTEMS FOR IOT		L	T	P	C
21A350404			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of IoT and embedded system including essence, basic design strategy and process modeling.
- To introduce students a set of advanced topics in embedded IoT and lead them to understand research in network.
- To develop comprehensive approach towards building small low cost embedded IoT system.
- To understand fundamentals of security in IoT
- To learn to implement secure infrastructure for IoT
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Implement an architectural design for IoT for specified requirement **(K2)**
CO2: Solve the given societal challenge using IoT **(K4)**
CO3: Understand and Choose between available technologies and devices for stated IoT challenge **(K3)**
CO4: Develop and document different application modules in IoT. **(K4)**
CO5: Understand features of IoT and using different datasets related to RTOS **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

INTRODUCTION TO EMBEDDED AND IOT SYSTEMS: Introduction Embedded and IoT systems, Definition, Examples and components of embedded and IoT Systems, Embedded and IoT Systems Design Process, Various Embedded and IoT cores controllers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Components of ES & IoT(L3)
- Differentiate between ES vs IoT (L3)
- Understand the ES Applications (L4)
- Implement Model in IoT (L2)

UNIT – II (8 Hrs)

HARDWARE/SOFTWARE CO-DESIGN FOR EMBEDDED AND IOT SYSTEMS: Microcontrollers for embedded systems, Arduino embedded platform, Peripheral interfacing and programming with Arduino platform, Sensors and Actuator interfacing, Cloud support with Arduino platform.

Learning Outcomes*:* At the end of this unit, students should be able to

- Knowledge about different microcontrollers (L3)
- Understand the different Interfacing Techniques (L3)
- Differentiate between Arduino and Cloud support (L3)

UNIT – III (9 Hrs)

PROTOCOLS FOR EMBEDDED AND IOT SYSTEMS: Serial protocols, UART, I2C, and SPI. NFC, Wireless protocols like, RFID, Zig-bee, IEEE 802.15.4e, Thread, 6LoWPAN, Constrained Application Protocol (CoAP), Extensible Messaging Protocol (XMPP), WebSocket, Advanced Message Queueing Protocol (AMQP), Message Queue Telemetry Transport (MQTT), Web Real Time Communications (WebRTC), LoRa, SIGFOX, Z Wave.

Learning Outcomes*:* At the end of this unit, students should be able to

- Various protocols in Embedded and IoT systems (L2)
- Study of different protocols (L3)
- Application Data on various protocol sets (L5)

UNIT – IV (8 Hrs)

OS BASED SOFTWARE DEVELOPMENT: Programming in higher level languages on embedded OS platform, Python and C programming, Various aspects of the OS designed for the IoT environment, open-source OS for IoT such as Contiki OS, TinyOS etc.

Learning Outcomes*:* At the end of this unit, students should be able to

- Programming in Embedded systems (L6)
- Design aspects of OS in IoT environment. (L6)
- Use of different open-source OS (L3)

UNIT – V (9 Hrs)

IOT BASED EMBEDDED SYSTEMS: Basic architecture of an IoT based Embedded Systems., Embedded Hardware for IoT applications, like Raspberry Pi, Arduino, and Raspberry Pi based development board, IoT Cloud Platform and IoT client applications on mobile phones.

Learning Outcomes*:* At the end of this unit, students should be able to

- Basic architecture of IoT based ES (L2)
- Understand the IoT applications (L6)
- Apply the different data bases in IoT and Cloud platform. (L6)

TEXTBOOKS:

1. "Embedded Programming Using C Language", Muhammad Ali Mazidi Shujen Chen, Sepehr Naimi Sarmad Naimi, 1st Edition, Freescale ARM Cortex-M

REFERENCE BOOKS:

1. "Embedded System: Architecture, Programming and Design", Rajkamal, TMH3
2. "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", Dr. OvidiuVermesan, Dr. Peter Friess, River Publisher

Course Code	MOBILE APPLICATION DEVELOPMENT LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050427			0	0	3	1.5
Pre-requisite	Object Oriented Programming through Java	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of android operating systems.
- To illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Build a native application using GUI components and Mobile application Development **(K3)**

CO2: To demonstrate their skills of using Android software development tools and construct an application using multimedia **(K3)**

CO3: Explore the android studio IDE, Build mobile application with dialogs and Fragments and design, develop menus with database in mobile applications **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	-	1	2	2	1	1	-	2	3	3
CO2	3	2	2	-	-	1	2	2	1	1	-	2	3	3
CO3	3	2	2	-	-	1	2	2	1	1	-	2	2	3

LIST OF EXPERIMENTS:

1. Setting Up the Development Environment Download & Install the SDK and the SDK Platform Components
2. Create "Hello World" Application Create a new Android Project Run "Hello World" on the Emulator and On a Physical Device Greeting the User.
2. Create Application by Using Widgets Creating the Application by using the Activity class
   (i) onCreate() (ii) onStart() (iii) onResume() (iv) onPause() (v) onStop() (vi) onDestroy() (vii) onRestart()
3. Creating the Application by using Text Edit control.
4. Creating the Application Choosing Options
   (i) CheckBox (ii) RadioButton (iii) RadioGroup (iv) Spinner
5. Create Application by Using Building Blocks for Android Application Design. Design the Application by using
   (i) Linear Layout (ii) Relative Layout (iii) Absolute Layout
6. Create the Application to play the Audio and Video clips.

7. Create Application by Using Building Menus and Storing Data.
8. Design the Application for Menus and Action Bar.
9. Design the application to display the Drop-Down List Action Bar.

TEXTBOOKS:

1. "Android Programming", B.M Harwani, Pearson Education, 2013

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">ARTIFICIAL INTELLIGENCE LAB
(Common to CSE, CSE-IOT)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A050428</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Pre-requisite</td><td>Advanced Data Structures through C++</td><td>Semester</td><td colspan="4">VI</td></tr>
</table>

COURSE OBJECTIVES:

- To explore the methods of implementing algorithms using artificial intelligence techniques
- To illustrate search algorithms
- To demonstrate building of intelligent agents

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Implement search algorithms **(K3)**
CO2: Solve Artificial intelligence problems **(K3)**
CO3: Design chatbot and virtual assistant **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	1	-	2	3	2	3	3	2
CO2	3	3	3	2	1	1	-	-	2	-	3	3	3	3
CO3	2	3	3	2	1	-	-	-	2	-	2	2	2	3

LIST OF EXPERIMENTS:

1. Write a program to implement DFS and BFS
2. Write a Program to find the solution for travelling salesman Problem
3. Write a program to implement Simulated Annealing Algorithm
4. Write a program to find the solution for wampus world problem
5. Write a program to implement 8 puzzle problem
6. Write a program to implement Towers of Hanoi problem
7. Write a program to implement A* Algorithm
8. Write a program to implement Hill Climbing Algorithm
9. Build a Chatbot using AWS Lex, Pandora bots.
10. Build a bot which provides all the information related to your college.
11. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
12. The following is a function that counts the number of times a string occurs in another string:

```
# Count the number of times string s1 is found in string s2
def countsubstring(s1,s2):
count = 0
for i in range(0,len(s2)-len(s1)+1):
```

if s1 == s2[i:i+len(s1)]:
count += 1
return count
For instance, countsubstring('ab','cabalaba') returns 2.
Write a recursive version of the above function. To get the rest of a string (i.e. everything but the first character).

13. Higher order functions. Write a higher-order function count that counts the number of elements in a list that satisfy a given test. For instance: count(lambda x: x>2, [1,2,3,4,5]) should return 3, as there are three elements in the list larger than 2. Solve this task without using any existing higher-order function.
14. Brute force solution to the Knapsack problem. Write a function that allows you to generate random problem instances for the knapsack program. This function should generate a list of items containing N items that each have a unique name, a random size in the range 1 .... 5 and a random value in the range 1 ..... 10.

    Next, you should perform performance measurements to see how long the given knapsack solver take to solve different problem sizes. You should perform at least 10 runs with different randomly generated problem instances for the problem sizes 10,12,14,16,18,20 and 22. Use a backpack size of 2:5 x N for each value problem size N. Please note that the method used to generate random numbers can also affect performance, since different distributions of values can make the initial conditions of the problem slightly more or less demanding.

    How much longer time does it take to run this program when we increase the number of items? Does the backpack size affect the answer? Try running the above tests again with a backpack size of 1 x N and with 4:0 x N.
15. Assume that you are organising a party for N people and have been given a list L of people who, for social reasons, should not sit at the same table. Furthermore, assume that you have C tables (that are infinitly large).

    Write a function layout(N,C,L) that can give a table placement (ie. a number from 0 : : :C -1) for each guest such that there will be no social mishaps.

    For simplicity we assume that you have a unique number 0 ......N-1 for each guest and that the list of restrictions is of the form [(X,Y), ...] denoting guests X, Y that are not allowed to sit together. Answer with a dictionary mapping each guest into a table assignment, if there are no possible layouts of the guests you should answer False.

ONLINE LEARNING RESOURCES:

1. Tensorflow: https://www.tensorflow.org/
2. Pytorch: https://pytorch.org/, https://github.com/pytorch
3. Keras: https://keras.io/, https://github.com/keras-team
4. Theano: http://deeplearning.net/software/theano/, https://github.com/Theano/Theano
5. Cafee2: https://caffe2.ai/, https://github.com/caffe2
6. Deeplearning4j: https://deeplearning4j.org/
7. Scikit-learn: https://scikit-learn.org/stable/, https://github.com/scikit-learn/scikit-learn
8. Deep Learning AI: https://www.deeplearning.ai/
9. OpenCv: https://opencv.org/, https://github.com/qqwweee/keras-yolo3
10. YOLO: https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/
11. nVIDIA CUDA: https://developer.nvidia.com/cuda-math-library
12. "Computational Intelligence : a logical approach", David Poole, Alan Mackworth, Randy Goebel, Oxford University Press, 2004.
13. "Artificial Intelligence: Structures and Strategies for complex problem solving", G. Luger, Pearson Education, 4th Edition, 2002.
14. "Artificial Intelligence: A new Synthesis", J. Nilsson, Elsevier Publishers, 1998.
15. "Artificial Neural Networks", B. Yagna Narayana, PHI
16. "Artificial Intelligence", E. Rich and K. Knight, TMH, 2nd Edition.
17. "Artificial Intelligence and Expert Systems", Patterson, PHI

Course Code	**CYBER PHYSICAL SYSTEMS LAB**		**L**	**T**	**P**	**C**
21A350405			**0**	**0**	**3**	**1.5**
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the components that make a cyber physical system
- To demonstrate cyber physical systems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design various cyber physical systems.**(K3)**

CO2: Build an IoT Communication model for connecting devices. **(K3)**

CO3: Design Environmental monitoring System **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO3	3	3	2	3	3	-	-	-	-	-	-	-	3	2

LIST OF EXPERIMENTS:

1. Develop a wearable assisted continuous authentication framework where a wearable device Like smart watch is used to authenticate a computer user continuously utilizing the motion sensors of the smart watch
2. Design a compromised device detection system in a grid
3. Design a Covid patient tracking system. The information about the Covid patients shall be
4. maintained in a website. The patients are to be tracked using mobile numbers. The system shall
5. keep track of the movement of the Covid patients based on their mobile numbers.
3. Design a prototype of the parking system which keeps track of empty parking spots and
6. informs the drivers entering a parking spot.
4. Design a milk quality checker system. Do a survey and identify the different adulterates that
7. may be added to the milk.
5. Design an automated seeding robot
6. Design an environmental monitoring system and informs the people particularly farmers
7. Design a medical alert system which alerts the elderly patients whenever it is time to take
8. medicines. Particular medicines and other value-added information may also be provided.
9. Design an intelligent stream lighting system
10. Design a PID based cyber physical system model for controlling room temperature
11. Build a line follower robot using Raspberry pi

12. Build an IoT Communication model for connecting devices

TEXTBOOKS:

1. "Cyber-Physical System: A Model Based Approach", Walid M. Taha, Abd-Elhamid M. Taha, Johan Thunberg,

REFERENCE BOOKS:

1. "Business Model Generation", Alexander Osterwalder, and Yves Pigneur, Wiley, 2011.
2. "Designing the Internet of Things", Adrian McEwen, Hakim Cassimally, Wiley Publications, 2012.

ONLINE LEARNING RESOURCES:

1. Cyber-Physical Systems Lab (ucdenver.edu)

Course Code	ARDUINO PROGRAMMING		L	T	P	C
21A350702			**1**	**0**	**2**	**2**
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the fundamentals of Internet of Things and its building blocks along with their characteristics
- To understand the recent application domains of IoT in day-to-day life
- To understand the protocols and standards designed for IoT

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the programming of basic Arduino examples. **(K2)**
CO2: Develop prototype circuits and connect them to the Arduino. **(K6)**
CO3: Practice the Arduino microcontroller to make the circuits work. **(K3)**
CO4: Execute the given example code and online resources for extending knowledge about the capabilities of the Arduino. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	1	-	-	-	-	-	-	-	-	-
CO2	3	3	2	3	1	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	1	-	-	-	-	-	-	-	-	-
CO4	3	3	-	3	1	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Module-1: Arduino

- Introduction to Arduino
- Pin configuration and architecture.
- Device and platform features.
- Concept of digital and analog ports.
- Familiarizing with Arduino Interfacing Board
- Introduction to Embedded C and Arduino platform

Module-2: Arduino Displays

- Working with Serial Monitor
- Line graph via serial monitor
- Interfacing a 8 bit LCD to Arduino
- Fixed one-line static message display.
- Running message display.
- Using the LCD Library of Arduino**.**

Module-3: Arduino Sensors

- Arduino – Humidity Sensor
- Arduino – Temperature Sensor
- Arduino – Water Detector / Sensor
- Arduino – PIR Sensor
- Arduino – Ultrasonic Sensor
- Arduino – Connecting Switch (Magnetic relay switches)

Case Study-1: Arduino Ping Pong Game
Design ping pong game using an Arduino Uno and Colour OLED display. The main objective of this game is to gain the highest score. This game is an interesting addictive fun game. This is a human vs human two-player game, and the players have to play from both sides with the help of up and down keys. The game ends whenever the player fails to touch the ball and it touches the other part of the screen. Also, the player must play the game turn-wise and use some strategy to win the game.
Source Link: https://www.youtube.com/watch?v=ZRL0GUqebFs

Case Study-2: Control Light & Fan with Clap using Arduino
Design a IoT application which controls the home appliances like Fan, TV, light and etc using sound effect. This project is very useful for elderly and differently abled persons to control their room with depending one other.
Source link: https://www.youtube.com/watch?v=hzUFnP3Xt7c

Case Study-3: Rain Alert System using Arduino
Design a system to alert the people when is raining. This system is very useful for vehicles to switch on the vipers as well as many places where the device working based on rain.
Source link: https://www.youtube.com/watch?v=YlIH1ti4Vy0

Case Study-4: Theft Alert System using Arduino
Design a system to alert the people using IR sensor when the motion is detected. This system is useful for high security areas. This system
Source link: https://www.youtube.com/watch?v=zOmsl-dTq8M

Case Study-5: Water Level Meter using Water Level Sensor
Design a sensor which can sense the water levelin tanks where the motor pumps are used. There is no specific method to checkthe level of the water.
Source Link: https://www.youtube.com/watch?v=n7WRi5U5lQk

REFERENCE BOOKS:

1. https://www.tutorialspoint.com/internet_of_things/index.htm
2. https://www.javatpoint.com/iot-internet-of-things
3. https://www.guru99.com/iot-tutorial.html

Course Code	RESEARCH METHODOLOGY (Common to all branches)		L	T	P	C
21A000004			**2**	**0**	**0**	**0**
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know how to define a Research problem, select suitable design and experimental approach. **(K1)**
CO2: Formulate sampling design and various techniques implemented on data collection. **(K6)**
CO3: Correlate any two variables and find the solution using regression analysis. **(K4)**
CO4: Examine hypothesis testing procedure, Analyze the significance of variance and covariance. **(K4)**
CO5: Write a report on research work for seminars, conferences formats. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (6 Hrs)

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of research and its process. (L2)
- Explain various types of research. (L2)
- Explain the steps involved in research design. (L2)
- Understand the different research approaches. (L2)

UNIT – II (6 Hrs)

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series

Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of sampling and sampling design. (L2)
- Explain various techniques in measurement and scaling. (L2)
- Understand various methods of data collection. (L2)
- Design survey questionnaires for different kinds of research. (L3)
- Analyze the questionnaires. (L4)

<u>UNIT – III</u> (6 Hrs)

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of correlation and regression. (L2)
- Compare and contrast correlation and regression. (L3)
- Explain various types of correlation. (L3)
- Apply the knowledge of C&R Analysis to get the results. (L3)

<u>UNIT – IV</u> (6 Hrs)

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Understand the hypothesis testing procedure. (L2)
- Compare and contrast Parametric and Non-parametric Tests. (L3)
- Understand the use of chi-square test in investigating the distribution of categorical variables. (L2)
- Analyze the significance of variance and covariance. (L4)

<u>UNIT – V</u> (6 Hrs)

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how to write a report and research paper. (L2)
- Explain various techniques of interpretation. (L2)
- Understand the importance of professional ethics in research. (L2)
- Design a scientific paper to present in the conferences/seminars. (L3)

TEXTBOOKS:

1. "Research Methodology: Methods and Techniques", C.R.Kothari, New Age International Publishers, 2nd Edition,.
2. "Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, Sage Publications

REFERENCE BOOKS:

1. "Research Methodology and Statistical Tools", P. Narayana Reddy and G. V. R. K. Acharyulu, Excel Books, New Delhi, 1st Edition.
2. "Business Research Methods", Donald R. Cooper & Pamela S Schindler, 9th Edition.
3. "Fundamentals of Statistics", S C Gupta, Himalaya Publications, 7th Edition

Course Code	5G TECHNOLOGY		L	T	P	C
21A350406			3	0	0	3
Pre-requisite	Computer Networks	Semester	VII			

COURSE OBJECTIVES:

- To learn the basics of 5G and beyond wireless communication
- To study 5G network architecture and Heterogeneous Network and Small cells
- To provide understanding of the key technologies and enablers of 5G
- To learn 5G technology like massive MIMO, mmWave etc

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Distinguish between the major cellular communication standards (1G/2G/3G/4G/5G systems) and architecture of wireless communication networks. **(K4)**

CO2: Apply the 5G techniques like massive MIMO, mmWave etc. for the design of communication systems. **(K3)**

CO3: Analyze various modulation and multiplexing techniques like OFDM, NOMA etc. **(K4)**

CO4: Describe applications of cognitive radio in 5G Wireless Communications. **(K2)**

CO5: Understand new trends in 5G Technology. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	2	-	-	-	-	-	-	2	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	2	3	3
CO5	3	3	3	3	2	-	-	-	-	-	-	2	3	3

UNIT – I (10 Hrs)

Introduction: Introduction to 5G Technology, Features, Requirements, Applications, 5G Services, Introduction to 5G, Digital modulations (OFDM, 5G Technology Modulation Techniques) and performance metrics, 5G Internet, Internet of Things and Context-Awareness, Software Defined Networking, Network Function Virtualisation (NFV).

5G Architecture : 5G Network Architecture, Cloud RAN(C-RAN), Definitions of Heterogeneous Networks, Radio Resource and Interference Management for Heterogeneous Networks, Traffic offloading scenarios for heterogeneous networks, mobility management and handover .

Learning Outcomes: At the end of this unit, students should be able to

- Gain basic familiarity with 5G Technology (L3)
- Distinguish OFDM and 5G Technology Modulation Techniques (L4)

UNIT – II (9 Hrs)

Mm Wave: mmWave: Millimeter bands, radio-wave propagation Physical layer design and algorithms, mmWave MIMO challenges, channel modelling, channel estimation and Beam-forming. Types of transceivers, Merits and Demerits, Applications.

Physical or Radio layer Technologies : Massive MIMO (Sub 6Ghz) -mm wave MIMO (above 6 GHz)

Learning Outcomes: At the end of this unit, students should be able to

- Learn how to apply mm Wave ,MIMO to design communication systems. (L3)
- Learn how to apply Radio layer Technologies like Massive MIMO, mm wave MIMO to design communication systems. (L3)

UNIT – III (8 Hrs)

NOMA: Non orthogonal Multiple Access (NOMA), Different Types: power domain NOMA and code domain NOMA, Difference between Orthogonal multiple access and NOMA, Filter Bank multi carrier -Full duplex Radio Techniques, Precoding .

Learning Outcomes: At the end of this unit, students should be able to

- Learn how to analyze various modulation and multiplexing techniques like OFDM, NOMA etc. (L4)
- Distinguish Orthogonal multiple access and NOMA. (L4)

UNIT – IV (10 Hrs)

Cognitive Radio for 5G Wireless Networks: Introduction, Overview of Cognitive Radio Technology in 5G Wireless, Spectrum Optimisation using Cognitive Radio, Cognitive Radio and Carrier Aggregation, Energy- Efficient Cognitive Radio Technology.

Cognitive Radios to Mitigate Interference in Macro/femto Heterogeneous Networks, Cognitive Radio enabled Operations, Interference Coordination: Orthogonality in the Time/Frequency domain, Intra-tier Interference mitigation, Compressive sensing.

Learning Outcomes: At the end of this unit, students should be able to

- Learn how to apply Cognitive Radio Technology in 5G Wireless Networks. (L3)
- Gain knowledge on Cognitive Radios to Mitigate Interference in Macro/femto Heterogeneous Networks. (L3)

UNIT – V (8 Hrs)

Trends in 5G: 5G NR, Carrier Aggregation in 5G, Open RAN, Use cases of 5G:eMBB, URLLC and mMTC, Advance applications: Robotic surgery, driverless car and Industrial IoT (IIoT), Tactile Internet, 5G-IoT applications, AR/VR in 5G

Learning Outcomes: At the end of this unit, students should be able to

- Gain knowledge on new trends in 5G Technology. (L3)
- Learn the Advance applications of 5G Technology like Robotic surgery, driverless car and Industrial IoT etc. (L3)

TEXTBOOKS:

1. "Principles of Modern Wireless communication systems", Aditya k Jagannathan.

2. "Millimeter Wave Wireless Communication", Robert W. Heath, Robert C. Daniel, James N. Theodore S. Rappaport, Murdock Prentice Hall, 2014.

REFERENCE BOOKS:

1. "Towards 5G: Applications, Requirements and Candidate Technologies", John Willey & Sons, West Sussex, 2017.
2. "5G and Beyond Wireless Systems PHY Layer Perspective, Series in Wireless Technology", Manish, M., Devendra, G., Pattanayak, P., Ha, N., Springer, 2021
3. "Design and deployment of small cell Networks", Alagan Anpalagan, Mehdi Bennis, Rath Vannithamby, Cambridge university press, 2015
4. "Heterogeneous Cellular Networks", Rose Qingyang Hu, Yi Qian, John Wiley & Sons, Ltd., Publication, 2013
5. "Multiple Access techniques for 5G Wireless Networks and Beyond ",M. Vaezi, Z. Ding and H. V. Poor, Springer Nature, Switzerland, 2019 .

Course Code	BIG DATA ANALYTICS USING HADOOP		L	T	P	C
21A050431	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VII			

COURSE OBJECTIVES:

- To familiarize with the installation of Hadoop and how to analyze the Big Data
- To understand the design concepts of HDFS
- To provide good insight for developing a MapReduce applications
- To understand Hadoop environment.
- To explore the concepts of Pig, Hive, Spark and HBase

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic concepts and importance of Big Data **(K2)**
CO2: Develop applications by installing and working with VMWare and Hadoop environment **(K4)**
CO3: Design MapReduce application with various input and output formats **(K4)**
CO4: Demonstrate cluster and Hive environment **(K3)**
CO5: Implement Pig, Spark and HBase applications **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	2	-
CO2	2	3	2	2	1	-	-	-	-	-	-	-	2	-
CO3	2	3	3	2	2	-	-	-	-	-	-	-	1	2
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction to Big Data: What is Big Data? Why Big Data is Important? Meet Hadoop, Data, Data Storage and Analysis, Comparison with other systems, History of Apache Hadoop, Hadoop Ecosystem, VMWare Installation of Hadoop. Analyzing the Data with Hadoop, Scaling Out.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the characteristics of datasets. (L3)
- Compare trivial data and big data for various applications. (L4)
- Choose and implement various ways of selecting suitable model parameters. (L1)

UNIT – II (9 Hrs)

HDFS: The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop File systems, The Java Interface, Data flow.

MapReduce: Developing a MapReduce application, The Configuration API, setting up the Development Environment, Running Locally on Test Data, Running on a Cluster

Learning Outcomes: At the end of this unit, students should be able to

- Understand and apply scaling up Hadoop techniques and associated technologies (L2)
- Estimate suitable test data. (L5)
- Apply the MapReduce application on a cluster. (L3)

UNIT – III (9 Hrs)

How MapReduce Works: Anatomy of a MapReduce, Job Run, Failures, Shuffle and Sort, Task Execution.

MapReduce Types and Formats: MapReduce Types, Input formats, output formats.

Learning Outcomes: At the end of this unit, students should be able to

- Explore the Anatomy of MapReduce. (L5)
- Illustrate various input and output formats of MapReduce. (L2)
- List various MapReduce types. (L1)

UNIT – IV (9 Hrs)

Hadoop Environment: Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration, Security.

Pig: Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User Defined Functions, Data Processing Operators.

Learning Outcomes: At the end of this unit, Student should be able to

- Show the cluster setup and installation. (L2)
- Demonstrate the Configure the Hadoop. (L2)
- Compare Hadoop with various Databases. (L5)

UNIT – V (8 Hrs)

Hive: Installing Hive, Running Hive, Comparison with traditional Databases, HiveQL, Tables, Querying Data.

Spark: Installing Spark, Resilient Distributed Datasets, Shared Variables, Anatomy of a Spark Job Run.

HBase: HBasics, Installation, clients, Building an Online Query Application.

Learning Outcomes: At the end of this unit, students should be able to

- Explain various frameworks of Big Data. (L2)
- Compare Hive with traditional Databases. (L4)
- Learn how to build an online query application. (L1)

TEXTBOOKS:

1. "Hadoop: The Definitive Guide", Tom White, 4th Edition, O'reilly Media, 2015

2. "Big Data, Big Analytics: Emerging business intelligence and analytic trends for today's businesses", Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, Wiley Cio Series

REFERENCE BOOKS:

1. "Making Sense of Data", Glenn J. Myatt, John Wiley & Sons, 2007
2. "Big Data Glossary", Pete Warden, O'Reilly, 2011.
3. "Intelligent Data Analysis", Michael Berthold, David J.Hand, Spingers, 2007.
4. "Understanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data", Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, McGraw Hill Publishing, 2012.
5. "Mining of Massive Datasets", Anand Rajaraman and Jeffrey David UIlman, Cambridge University Press, 2012.

Course Code	DEEP LEARNING (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050432			3	0	0	3
Pre-requisite	Artificial Intelligence	Semester	VII			

COURSE OBJECTIVES:

- To demonstrate the major technology trends driving Deep Learning
- To build, train, and apply fully connected deep neural networks
- To implement efficient (vectorized) neural networks
- To analyse the key parameters and hyper parameters in a neural network's architecture

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the mathematical foundation of neural network. **(K2)**
CO2: Describe the machine learning basics **(K4)**
CO3: Differentiate architecture of deep neural network **(K3)**
CO4: Build a Convolution Neural Network **(K4)**
CO5: Build and train RNN and LSTMs **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms,Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.
Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' ule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.
Learning Outcomes: At the end of this unit, students should be able to

- Understand the tensors, SVD (L3)
- Differentiation between SVD and PCA (L3)
- Understand the different types of pdfs (L4)
- Implementation of Optimization(L2)

UNIT – II (9 Hrs)

Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the validation sets, maximum likely hood (L3)
- Differentiation between Supervised and Unsupervised Learning (L3)
- Implementation of MLP and Solution to XOR problem (L2)

UNIT – III (9 Hrs)

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Constrained Optimization (L3)
- Optimization for Training deep models (L4)
- Implement of Meta Algorithms(L2)

UNIT – IV (9 Hrs)

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the CNN algorithm and its applications in Image Processing (L3)
- Defining the structured outputs (L2)
- Implementation of CNN(L2)

UNIT – V (8 Hrs)

Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the RNN structures (L3)
- Differentiation between LSTM, Gated RNN (L3)
- Implement Deep Generative Models(L2)

TEXTBOOKS:

1. "Deep Learning", Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2016.
2. "Deep learning: A practitioner's approach", Josh Patterson and Adam Gibson, O'Reilly Media, First Edition, 2017.

REFERENCE BOOKS:

1. "Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms", Nikhil Buduma, O'Reilly, Shroff Publishers, 2019.
2. "Deep learning Cook Book, Practical recipes to get started Quickly", Douwe Osinga, O'Reilly, Shroff Publishers, 2019.

ONLINE LEARNING RESOURCES:

1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf
4. https://www.cse.iitm.ac.in/~miteshk/CS7015.html
5. https://www.deeplearningbook.org
6. https://nptel.ac.in/courses/106105215

Course Code	COMPUTER VISION WITH OPENCV		L	T	P	C
21A350407			3	0	0	3
Pre-requisite	Python Programming & Data Science	Semester	VII			

COURSE OBJECTIVES:

- To understand the basic issues in computer vision and major approaches
- To address the methods to learn the Linear Filters, segmentation by clustering, Edge detection, Texture.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand basic concepts, terminology, theories, models and methods in the field of computer vision **(K2)**

CO2: Describe known principles of human visual system **(K2)**

CO3: Describe basic methods of computer vision related to multi-scale representation, edgedetection and detection of other primitives, stereo, motion and object recognition **(K2)**

CO4: Design a computer vision system for a specific problem **(K6)**

CO5: Design a computer vision system **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

UNIT – I (8 Hrs)

LINEAR FILTERS: Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT – II (9 Hrs)

EDGE DETECTION: Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners

UNIT – III (9 Hrs)

TEXTURE: Representing Texture –Extracting Image Structure with Filter Banks, Representing Texture using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids –The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes

UNIT – IV (8 Hrs)

SEGMENTATION BY CLUSTERING: What is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction. Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves

UNIT – V (8 Hrs)

RECOGNITION BY RELATIONS BETWEEN TEMPLATES: Finding Objects by Voting on Relations between Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and Sign Language Understanding, Finding People with HMM.

TEXTBOOKS:

1. "Computer Vision – A modern Approach", David A. Forsyth, Jean Ponce, PHI, 2003.

REFERENCE BOOKS:

1. "Geometric Computing with Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics", Sommer, Springer, 1st Edition, 2001.
2. "Digital Image Processing and Computer Vision", Sonka, 1st Edition.
3. "Computer Vision and Applications: Concise Edition", Jack Academy Press, 2000.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106105216https://nptel.ac.in/courses/108103174

Course Code	DESIGN PATTERNS		L	T	P	C
21A050435	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VII			

COURSE OBJECTIVES:

- To understand design patterns and their underlying objects oriented concepts.
- To learn the day-to-day problems faced by object-oriented designers and how design patterns solve them
- To provide an interface for creating families of related objects without specifying their concrete classes.
- To know the consequences of combining patterns on the overall quality of a system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solving various Problems Using Design Patterns. **(K3)**
CO2: Applying various patterns to problems in designing lexi. **(K3)**
CO3: Comparing various structural patterns. **(K4)**
CO4: Applying Behavioral Patterns to various design issues. **(K3)**
CO5: Analysing and comparing various Patterns. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	2
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	3	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	3	-

UNIT – I (9 Hrs)

Introduction to Design Patterns: Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing the Catalog, Solving of Design Problems using Design Patterns, Selection of a Design Pattern, Use of Design Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Develop design patterns in Small Talk MVC (L6).
- How to select and use a Design Pattern (L1).
- Solve problems using design patterns (L3).

UNIT – II (9 Hrs)

Designing A Document Editor: Design problems, Document structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel standards, Supporting

Multiple Window Systems, User Operations, Spelling Checking and Hyphenation. Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Apply eight different patterns to Document editor's design. (L3).
- Specify the kinds of objects to create new objects using prototype(L4).

UNIT - III (9 Hrs)

Structural Patterns: Structural Patterns-1: Adapter, Bridge, Composite. Structural Patterns-2: Decorator, Facade, Flyweight, Proxy, Discuss of Structural Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Understand structural patterns (L2).
- Explain adapter, bridge and composite structural patterns (L2).
- Create decorator, facade, flyweight and proxy structural patterns (L6)

UNIT – IV (9 Hrs)

Behavioural Patterns: Behavioural Patterns-1: Chain of Responsibility, Command, Interpreter, Iterator. Behavioural Patterns-2: Mediator, Memento, Observer.

Learning Outcomes: At the end of this unit, students should be able to

- Define behavioural patterns (L1).
- Demonstrate object scope behavioural patterns (L2).
- Justify description for different types of behavioural patterns (L5).

UNIT – V (8 Hrs)

Behavioural Patterns and History: Behavioural Patterns-2(cont'd): State, Strategy, Template Method, Visitor, and Discussion of Behavioural Patterns. What to Expect from Design Patterns, a Brief History. The Pattern Community, An Invitation, A Parting Thought

Learning Outcomes: At the end of this unit, students should be able to

- Identify behavioural patterns (L6).
- Justify different types of behavioural patterns (L5).
- Determine community for patterns (L4).

TEXTBOOKS:

1. "Design Patterns", Erich Gamma, Pearson Education.

REFERENCE BOOKS:

1. "Patterns in JAVA", Vol-I , Mark Grand, Wiley DreamTech.
2. "Patterns in JAVA", Vol-II, Mark Grand, Wiley DreamTech.
3. "JAVA Enterprise Design Patterns", Vol-III, Mark Grand, Wiley DreamTech.

4. "Pattern Oriented Software Architecture", Buschmann & others, John Wiley & Sons.

ONLINE LEARNING RESOURCES:

1. https://refactoring.guru/design-patterns
2. https://www.geeksforgeeks.org/software-design-patterns/
3. https://en.wikipedia.org/wiki/Software_design_pattern

Course Code	NATURAL LANGUAGE PROCESSING		L	T	P	C
21A350408			3	0	0	3
Pre-requisite	Artificial Intelligence	Semester	VII			

COURSE OBJECTIVES:
- To explain and apply fundamental algorithms and techniques in the area of natural language processing
- To understand approaches to syntax and semantics in NLP.
- To understand current methods for statistical approaches to machine translation.
- To understand language modelling.
- To understand machine learning techniques used in NLP.

COURSE OUTCOMES:
After completion of the course, the student will be able to
CO1: Understand the logic behind Natural languages **(K2)**
CO2: Understand the significance of syntax and semantics of natural languages **(K2)**
CO3: Process the Natural languages **(K3)**
CO4: Verify the syntax and semantics of languages **(K3)**
CO5: Design new natural languages **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	-	-	-	-	-	-	-	-	1	-
CO2	2	2	1	3	-	-	-	-	-	-	-	-	1	-
CO3	3	2	2	3	-	-	-	-	-	-	-	-	1	-
CO4	2	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	3	-	-	-	-	-	-	-	-	-	2

UNIT – I (8 Hrs)
INTRODUCTION TO NATURAL LANGUAGE: The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.
Learning Outcomes: At the end of this unit, students should be able to
- Classify different Levels of Language Analysis (L1)
- Understand Natural language systems (L3)
- Study Linguistic Background (L3)

UNIT – II (8 Hrs)
GRAMMARS AND PARSING: Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy.

Learning Outcomes: At the end of this unit, students should be able to

- Study different types of Grammars and Parsing (L4)
- Understand Morphological Analysis and the Lexicon(L5)
- Analyse Entropy and Cross Entropy. (L4)

UNIT – III (9 Hrs)

GRAMMARS FOR NATURAL LANGUAGE: Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

Learning Outcomes: At the end of this unit, students should be able to

- Study different types of Grammars for NLP (L4)
- Demonstrate Handling questions in Context Free Grammar (L6)
- Analyse Shift Reduce Parsers & Deterministic Parsers. (L5)

UNIT – IV (9 Hrs)

INTERPRETATION AND MODELLING: Semantic Interpretation-Semantic & Logical form, Word senses & ambiguity, the basic logical form language, encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory. Language Modelling-Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.

Learning Outcomes: At the end of this unit, students should be able to

- Study Semantic Interpretation & Logical form (L5)
- Demonstrate speech acts & embedded sentences (L4)
- Analyse Multilingual and Cross lingual Language Modelling. (L3)

UNIT – V (9 Hrs)

MACHINE TRANSLATION AND MULTILINGUAL INFORMATION: Machine Translation Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusaraka Output, Language Bridges. Multilingual Information Retrieval - Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources. Multilingual Automatic Summarization - Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

Learning Outcomes: At the end of this unit, students should be able to

- Study Machine Translation Survey (L4)
- Demonstrate Anusaraka or Language Accessor Background (L5)
- Analyse Multilingual Automatic Summarization. (L3)

TEXTBOOKS:

1. "Natural Language Understanding", James Allen, Pearson Education, 2nd Edition, 2003.
2. "Multilingual Natural Language Processing Applications: From Theory to Practice", Daniel M. Bikel and Imed Zitouni, Pearson Publications.
3. "Natural Language Processing, A paninian perspective", Akshar Bharathi, Vineet Chaitanya, Prentice Hall of India.

REFERENCE BOOKS:

1. "Statistical Language Learning", Charniack, Eugene, MIT Press, 1993.
2. "Speech and Language Processing", Jurafsky, Dan and Martin, James, Prentice Hall, 2nd Edition, 2008.
3. "Foundations of Statistical Natural Language Processing, Manning, Christopher and Henrich, Schutze, MIT Press, 1999.

ONLINE LEARNING RESOURCES:

1. http://peterindia.net/AILinks.html

Course Code	**CYBER SECURITY**		**L**	**T**	**P**	**C**
21A050433	(Common to CSE, CSE-IOT)		**3**	**0**	**0**	**3**
Pre-requisite	Computer Networks	Semester	VII			

COURSE OBJECTIVES:

- To understand essential building blocks and basic concepts of cyber security
- To explore Web security and Network security
- To explain the measures for securing the networks and cloud
- To understand privacy principles and policies
- To describe the legal issues and ethics in computer security

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection **(K3)**

CO2: Assess the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure **(K4)**

CO3: Identify the nature of secure software development and operating systems **(K3)**

CO4: Demonstrate the role security management in cyber security defense **(K2)**

CO5: Adapt the legal and social issues at play in developing solutions **(K3)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	2-
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Vulnerabilities, threats and. Counter measures for computer security (L2)
- Interpret the design of the malicious code (L2)

UNIT – II (9 Hrs)

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the attacks on browser, Web and email. (L2)
- Explain the security aspects of Operating Systems. (L3)

<u>UNIT – III</u> (9 Hrs)

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management.

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network security threats and attacks. (L3)
- Design the Counter measures to defend the network security attacks. (L4)
- Analyze the security tools and techniques for Cloud computing (L4)

<u>UNIT – IV</u> (8 Hrs)

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster

Learning Outcomes: At the end of this unit, students should be able to

- Interpret the need for Privacy and its impacts of Emerging Technologies. (L2)
- Explain how to handle incidents and deal with Disaster. (L2)

<u>UNIT – V</u> (8 Hrs)

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

Learning Outcomes: At the end of this unit, students should be able to

- Adapt legal issues and ethics in computer security. (L4)
- Elaborate on the Emerging topics. (L4)

<u>TEXTBOOKS:</u>

1. "Security in Computing", Pfleeger, C.P., Prentice Hall, 2010, 5th Edition.

2. "Applied Cryptography", Bruce Schneier, John Wiley & Sons, 2nd Edition,1996

REFERENCE BOOKS:

1. "Information Security: The Complete Reference", Mark Rhodes-Ousley, 2nd Edition.
2. "Information Security Management: Concepts and Practice", McGraw-Hill, 2013.
3. "Roadmap to Information Security for IT and Infosec Managers", Michael E. Whitman, and Herbert J. Mattord, Boston, Course Technology, 2011

Course Code	DIGITAL FORENSICS		L	T	P	C
21A350409			3	1	0	3
Pre-requisite	Digital Logic Design & Computer Organization, Operating Systems	Semester	VII			

COURSE OBJECTIVES:

- To understand cybercrimes and their Operandi to analyze the attack.
- To Study and Describe Forensic science and Digital Forensics
- To perform digital evidence investigations
- To understand cybercrimes and their Operandi to analyze the attack
- To apply forensic analysis tools to recover important evidence for identifying computer crime.
- To be well-trained as next-generation computer crime investigators

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe Forensic science and Digital Forensic concepts **(K2)**

CO2: Undertake basic digital forensic investigation, from data acquisition and validation to evidence discovering, analyzing, validating, and presenting, by using a variety of digital forensics tools **(K4)**

CO3: Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards **(K2)**

CO4: Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity **(K3)**

CO5: Analyze the digital evidence used to commit cyber offences **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	-	3	-	1	-	-	-	-	3	-	-	3	-
CO3	-	1	3	-	-	-	-	2	-	3	-	-	3	1
CO4	-	-	3	-	-	-	-	2	-	3	-	-	3	-
CO5	2	-	-	1	-	-	-	-	-	-	1	-	-	-

UNIT – I (8 Hrs)

INTRODUCTION: Understanding of forensic science, digital forensic, uses of digital forensic , Locard's exchange principle, Scientific method. Understanding of the technical concepts: Basic computer organization, File system, Memory organization concept, Data storage concepts, Computing environments

Learning Outcomes: At the end of this unit, students should be able to

- Explain the origins of forensic science (L2)
- Define and explain digital forensic procedures and investigative findings to diverse

stakeholders (L2)
- Explain the role of digital forensics and the relationship of digital forensics to traditional forensic science, traditional science and the appropriate use of scientific methods (L2)

UNIT – II (8 Hrs)

UNDERSTANDING DIGITAL FORENSICS: Forensic Laboratories ,policies and procedures, Quality assurance, Tool validation, Digital forensic tools Tool selection, Hardware and Software tools

COLLECTING EVIDENCE: Introduction to cybercrime scene, Documenting the scene and evidence, maintaining the chain of custody, forensic cloning of evidence, Live and dead system forensic, Hashing concepts to maintain the integrity of evidence, Report drafting.

Learning Outcomes: At the end of this unit, students should be able to
- Use appropriate tools and techniques to collect and recover data from a variety of digital sources (L3)
- Adhere to highest ethical standards, obey the laws and follow procedures at all times when collecting and dealing with digital evidence (L3)
- Select and use current forensic tools to perform digital investigations(L3)

UNIT – III (10 Hrs)

COMPUTER OPERATING SYSTEM ARTIFACTS: Finding deleted data, hibernating files, examining window registry, recycle bin operation, understanding of metadata, Restore points and shadow copies

ANTI FORENSICS: Hiding data, Password Attacks, Steganography, Data destruction

Learning Outcomes: At the end of this unit, students should be able to
- Identify and apply current practices for processing crime and incident scenes (L4)
- Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards (L4)

UNIT – IV (9 Hrs)

LEGAL ASPECTS OF DIGITAL FORENSICS: Understanding of legal aspects and their impact on digital forensics, Electronics discovery

INTERNET AND E-MAIL: Understanding of Internet resources, Web browser, Email header forensic, social networking sites

Learning Outcomes: At the end of this unit, students should be able to
- Develop and follow suitable processes when performing incident response and conducting digital forensics investigations(L3)
- Facilitate efficient memory utilization (L5)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT – V (9 Hrs)

NETWORK FORENSICS: Social Engineering, Network Fundamentals, Network Security Tools, Network Attacks, Incident Response, Network Evidence and Investigations.

MOBILE DEVICE FORENSICS: Cellular Networks, Operating Systems, Cell Phone Evidence, Cell Phone Forensic Tools, Global Positioning Systems (GPS)

Learning Outcomes: At the end of this unit, students should be able to

- Apply a solid foundational grounding in computer networks, operating systems, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity (L3)

TEXTBOOKS:

1. "The basics of digital Forensics (Latest Edition) – The primer for getting started in digital Forensics", John Sammons, Elsevier Syngress Imprint
2. "Cybersecurity – Understanding of cybercrimes, computer forensics and Legal perspectives", Nina Godbole and Sunit Belapure, Wiley India Publication
3. "Practical Digital Forensics", Richard Boddington, (PACKT) Publication, Open source Community

REFERENCE BOOKS:

1. "Computer Forensics: Incident Response Essentials", Warren G. Kruse II and Jay G. Heiser, Addison Wesley, 2002.
2. "Guide to Computer Forensics and Investigations, Nelson, B, Phillips, A, Enfinger, F, Stuart, C., Thomson Course Technology, 2nd Edition, 2006.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/
2. https://www.coursera.org/
3. https://www.infosecawareness.in

Course Code	INTERNET OF THINGS AND MULTIMEDIA SYSTEMS		L	T	P	C
21A350410			3	1	0	3
Pre-requisite	Computer Networks	Semester	VII			

COURSE OBJECTIVES:

- To explore the interconnection and integration of the physical world and the cyber space.
- To design & develop IoT Devices.
- To formulate a working definition of interactive multimedia
- To demonstrate competence in using the authoring program HyperStudio
- To use animation, digitized sound, video control, and scanned images

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the Application areas of IoT **(K2)**
CO2: Understand concepts of IoT-based Multimedia Applications **(K2)**
CO3: Summarize the importance of Multimedia Application **(K2)**
CO4: Design Interactive multimedia applications **(K6)**
CO5: Predict the sound suitable for application **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	3	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3

UNIT – I (9 Hrs)

INTRODUCTION TO INTERNET OF THINGS: Introduction, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies**.** Domain Specific IoTs Introduction, Home Automation, cities, Environment, Retail, Agriculture, Industry, Health & Lifestyle.

Learning Outcomes: At the end of this unit, students should be able to

- Explain IoT architecture. (L3)
- Interpret the design principles that govern connected devices (L2)
- Summarize the roles of various organizations for IoT (L2)

UNIT – II (9 Hrs)

INNOVATION IN MULTIMEDIA USING IOT SYSTEMS: Introduction, IoT-Enabled Multimedia Frameworks, IoT-based Multimedia Applications, Proposed Framework for IoT Multimedia Service Delivery, Challenges and Limitations, Open Research Issues.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the IoT-based Multimedia Applications (L4)
- Discover the Need for IoT Multimedia Service Delivery (L3)

<u>UNIT – III</u> (10 Hrs)

MULTIMEDIA AUTHORING: Multimedia Overview, Definition Applications and Design, Authoring (HyperStudio), Introduction to HyperStudio, The Metaphor, The Basics (Cards, Buttons, Text), HyperStudio, Resources. Multimedia Authoring- Multimedia Authoring Metaphors, Multimedia Production, Multimedia Presentation, Automatic Authoring, Some Useful Editing and Authoring Tools, Adobe Premiere, Macromedia Director, Macromedia Flash, Dreamweaver.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the importance of Multimedia Application (L3)
- Explain the basics of multimedia and Animation. (L2)
- Understand various tools for multi-media (L2

<u>UNIT – IV</u> (8 Hrs)

INSTRUCTIONAL DESIGN: Objectives, Content (print, graphics, sounds, etc.), Interaction, Assessment, Closure, Screen Design: Metaphors and Themes, Colors and Backgrounds, Text (size, color, placement), Navigation, Consistency.

Learning Outcomes: At the end of this unit, students should be able to

- Design Interactive multimedia applications (L6)
- Correlate colors, backgrounds and text (L4)

<u>UNIT – V</u> (8 Hrs)

TRANSITIONS AND LINKS: Use of Sound, HyperStudio Sounds, Recording Your Own, Internet Resources, Graphics, Integrating Web documents, HyperStudio Tips and Tricks, Animation, Launching other applications and documents.

Learning Outcomes: At the end of this unit, students should be able to

- Integrate sound into the Multimedia Applications (L6)
- Select the sound suitable for application (L5)

<u>TEXTBOOKS:</u>

1. “Internet of Things a Hands-on Approach”, Arshdeep Bahga and Vijay Madisetti. University Press.
2. “Multimedia Computing Systems and Virtual Reality”, Rajeev Tiwari, Neelam Duhan, Mamta Mittal, Abhineet Anand and Muhammad Attique Khan. CRC Press.
3. “A Guide to Computer Animation: for TV, games, multimedia and web”, Marcia Kuperberg, Focal Press (Taylor and Francis Group), 2002.

4. "Fundamentals of Multimedia", Z. N. Li and M. S. Drew, Pearson Prentice Hall

REFERENCE BOOKS:

1. "Internet of Things: Architecture, Design Principles and Applications", Raj Kamal McGraw Hill Edition.
2. "Animation from Pencils to Pixels: Classical Techniques for Digital Animators", Tony White, Focal Press (Taylor and Francis Group), 2006.
3. "Creativity, INC: Overcoming the unseen forces that stand in the way of True Inspiration", ED Catmull, Trans World Publishers, 2014.

<table>
<tr><td>Course Code</td><td rowspan="2">MANAGEMENT SCIENCE
(Common to all Branches)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A110204</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="3">VII</td></tr>
</table>

COURSE OBJECTIVES:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concepts and principles of management in real life industry design and develop organization chart and structure for an enterprise. **(K3)**

CO2: Apply operations management techniques in real life industry. **(K3)**

CO3: Apply the concepts of HRM in Recruitment, Selection, Training & Development. **(K3)**

CO4: Develop PERT/CPM charts for projects of an enterprise and estimate time & cost of a project and to develop Mission, Objectives, Goals & Strategies for an enterprise in dynamic environment. **(K3)**

CO5: Understand & apply modern management techniques wherever possible. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	3	-	-	-

UNIT – I (9 Hrs)

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of management and organization (L2)

- Apply the concepts & principles of management in real life industry (L3)
- Analyze the organization chart & structure for an enterprise.(L4)
- Evaluate and interpret the theories and the modern organization theory (L5)

UNIT – II (10 Hrs)

Operations Management: Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming‘s contribution to Quality. **Material Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the core concepts of Management Science and Operations Management (L2)
- Apply the knowledge of Quality Control, Work-study principles in real life industry (L3)
- Evaluate Materials departments & Determine EOQ (L5)
- Analyze Marketing Mix Strategies for an enterprise (L4)
- Create and design advertising and sales promotion (L5)

UNIT – III (6 Hrs)

HUMAN RESOURCES MANAGEMENT: HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development (L2)
- Apply Managerial and Operative Functions (L3)
- Analyze the need of training (L4)
- Evaluate performance appraisal (L5)
- Design the basic structure of salaries and wages (L5)

UNIT – IV (12 Hrs)

Strategic & Project Management: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical

Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

Learning Outcomes: At the end of this unit, students should be able to

- Understand Mission, Objectives, Goals & Strategies for an enterprise (L2)
- Apply SWOT Analysis to strengthen the project (L3)
- Analyze Strategy formulation and implementation (L4)
- Evaluate PERT and CPM Techniques (L5)
- Create in competing the projects within given time (L5)

<u>UNIT – V</u> (8 Hrs)

Contemporary Issues in Management: The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand modern management techniques (L2)
- Apply Knowledge in modern management (L3)
- Analyze CRM, TQM (L4)
- Evaluate Six Sigma concept and SCM (L5)

<u>TEXTBOOKS:</u>

1. "Management Science", A.R Aryasri, TMH, 2013
2. "Management", Stoner, Freeman, Gilbert, Pearson Education, New Delhi, 2012.

<u>REFERENCE BOOKS:</u>

1. "Essentials of Management", Koontz &Weihrich, TMH, 6th Edition, 2005.
2. "Management Principles and Guidelines", Thomas N. Duening & John M. Ivancevich, Biztantra.
3. "Production and Operations Management", Kanishka Bedi, Oxford University Press, 2004.
4. "Modern Management", Samuel C. Certo, 9th Edition, PHI, 2005

Course Code	**HACKING TOOLS**		**L**	**T**	**P**	**C**
21A050706	(Common to CSE, CSE-AI, CSE-IOT, AIML)		**1**	**0**	**2**	**2**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the effects of Hacking
- To protect themselves from hacking
- To identify various types of Hacking Tools

.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various Hacking Threats.**(K4)**

CO2: Perform various Hacking Methods.**(K3)**

CO3: Evaluate the various types of Hacking Techniques **(K4)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	2

LIST OF EXPERIMENTS:

Week 1

Network Security and Threats, Cyber Ethics Hacking Introduction

Week 2

Scanners :- What is scanning? How to perform Scanning on a demo-website.

Week 3

Viruses and worms and Trojans. Virus Analysis

Week 4

Snooping:- Email, DNS and IP

Week 5

Honey Pots: Creation and Execution

Week 6

Information Gathering , Session Hijacking

Week 7

Hacking Wireless Networks

Week 8 & 9
SQL injections and Hacking Mobiles

Week 10 & 11
Social Engineering and safety requirements

TEXTBOOKS:

1. "Hack-x-crypt: a straight forward guide towards ethical hacking and cyber-Security", Udval sahay

REFERENCE BOOKS:

1. "ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking", Hein Smith

ONLINE LEARNING RESOURCES:

1. https://www.synopsys.com/glossary/what-is-ethical-hacking.html#:~:text=Definition,and%20actions%20of%20malicious%20attackers.
2. https://intellipaat.com/blog/what-is-ethical-hacking/

OPEN ELECTIVE – I

Course Code	AIR POLLUTION AND CONTROL		L	T	P	C
21A010501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To identify the sources of air pollution
- To know the composition and structure of atmosphere
- To know the pollutants dispersion models
- To understand the working of air pollution control equipment
- To identify the sources of noise pollution and their controlling methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the sources of air pollution. **(K2)**
CO2: Explain the composition and structure of atmosphere. **(K4)**
CO3: Discuss the general characteristics of stack emissions and their behavior. **(K2)**
CO4: Understand the mechanism of Control of air pollutants. **(K2)**
CO5: Know about the noise sources, mapping, prediction equations etc. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	-	-	-	3	1	-	-	-	-	3	1
CO2	3	1	3	-	-	-	3	1	-	-	-	-	1	1
CO3	3	2	2	-	-	-	3	1	-	-	-	-	2	2
CO4	3	1	2	-	-	-	3	1	-	-	-	-	1	1
CO5	3	2	2	-	-	-	3	1	-	-	-	-	1	2

UNIT – I (9 Hrs)

Introduction: sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance. Indoor Air Pollution– sources, effects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the character of atmospheric pollutants and their effect. (L4)

UNIT – II (9 Hrs)

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Wind rose diagram.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the composition and structure of atmosphere. (L4)
- Write the maximum mixing depth and windrose diagram. (L6)

UNIT – III (9 Hrs)

General characteristics of stack emissions, plume behavior, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources. Monitoring of particulate matter and gaseous pollutants –respirable, non-respirable and nano - particulate matter. CO, CO2, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

Learning Outcomes: At the end of this unit, students should be able to

- Express about the general characteristics of stack emissions and their behavior. (L6)
- Analyze the monitoring of particulate matter and gaseous pollutants. (L4)

UNIT – IV (9 Hrs)

Air Pollution Control equipment for particulate matter & gaseous pollutants– gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – Adsorption, Absorption, Scrubbers, Condensation and Combustion.

Learning Outcomes: At the end of this unit, student should be able to

- Explain the various air pollution control equipment. (L3)

UNIT – V (9 Hrs)

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the noise sources, mapping, prediction equations etc., (L5)

TEXTBOOKS:

1. “Air Pollution - Its Origin and Control”, Wark K., Warner C.F., and Davis W.T, Harper & Row Publishers, New York.
2. “Environmental Engineering”, H.S. Peavy, D.R. Row & G. Tchobanoglous, Mc Graw Hill International Edition

REFERENCE BOOKS:

1. “Air Pollution”, Perkins H.C., McGraw Hill.
2. “Air Pollution Control Theory”, Crawford M., TATA McGraw Hill.
3. “Air Pollution”, Stern A.C., Volume I, II, III.
4. “Air Pollution”, Seinfeld N.J., McGraw Hill.
5. “Air Quality Management”, Stern A.C., Volume V.
6. “Air Pollution”, M N Rao and HVN Rao, Tata McGraw Hill publication

ONLINE LEARNING RESOURCES:

1. http://www.epa.gov
2. http://www.indiaenvironmentportal.org.in
3. http://nptel.iitm.ac.in
4. http://www.filtersource.com

Course Code	ELECTRIC VEHICLES		L	T	P	C
21A020501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- Get exposed to EV system configuration and parameters
- Know about electro mobility and environmental issues of EVs
- Understand about basic EV propulsion and dynamics
- Understand about fuel cell technologies for EV and HEVs
- Know about basic battery charging and control strategies used in electric vehicles

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand and differentiate between conventional and latest trends in Electric vehicles. **(K2)**

CO2: Analyze various EV resources, EV dynamics and Battery charging. **(K4)**

CO3: Apply basic concepts of EV to design complete EV system. **(K3)**

CO4: Design EV system with various fundamental concepts. **(K5)**

CO5: Analyze the various control strategies used in battery charging in the electric vehicles. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to EV Systems and Parameters: Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic concepts of EV to design complete EV system. (L3)
- Explain EV system configuration. (L3)
- Understand various EV parameters. (L2)

UNIT – II (9 Hrs)

EV and Energy Sources: Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand electro mobility and environmental issues of EVs. (L2)
- Explain the history of Electric power trains. (L3)
- Compare conventional, battery, hybrid and fuel cell electric systems. (L3)

UNIT – III (9 Hrs)

EV Propulsion and Dynamics: Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi-motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of EV system. (L2)
- Choose a suitable electric propulsion system. (L2)
- Classify EV motors and their applications. (L3)

UNIT – IV (9 Hrs)

Fuel Cells: Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples.

Learning Outcomes: At the end of this unit, students should be able to

- FUEL CELLS: Explain the working principle of Fuel cells. (L3)
- Analyze fuel cell technologies for EV and HEVs. (L4)
- Compare series, series-parallel hybrid systems. (L3)

UNIT – V (9 Hrs)

Battery Charging and Control: Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modeling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic battery charging in Electric Vehicles. (L2)
- Analyze control strategies used in electric vehicles. (L4)

TEXTBOOKS:

1. "Modern Electric Vehicle Technology", C.C Chan, K.T Chau, Oxford University Press Inc., New York 2001.

2. “Electric Vehicle Technology Explained”, James Larmenier, John Lowry, Wiley, 2003.

REFERENCE BOOKS:

1. “Electric and Hybrid Vehicles Design Fundamentals”, Iqbal Husain, CRC Press 2005.
2. “Advanced Electric Drive Vehicles”, Ali Emadi, CRC Press, 2015.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

Course Code	ELECTRICAL DISTRIBUTION SYSTEMS		L	T	P	C
21A020502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- The classification of distribution systems
- The aspects and design considerations in DC and AC distribution and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the various factors associated with power distribution. **(K3)**
CO2: Make voltage drop calculations in given distribution networks. **(K3)**
CO3: Learn principles of substation maintenance. **(K2)**
CO4: Compute power factor improvement for a given system and load. **(K3)**
CO5: Understand implementation of SCADA for distribution automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Load Modeling and Characteristics: Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural, and Industrial) and Their Characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of the electrical distribution systems. (L2)
- Analyze the relationship between load factor and loss factor. (L4)
- Understand the various loads and its characteristics. (L2)

UNIT – II (9 Hrs)

Classification Of Distribution Systems: Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and

Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the classification of electrical distribution systems. (L2)
- Analyze the design considerations of the radial and loop type feeders. (L4)

<u>UNIT – III</u> (9 Hrs)

Substations: Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar Sectionalized Single Bus Bar, With Relevant Diagrams.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the layout of the substation and various equipment installed. (L2)
- Analyze the classification of the substation based on insulating medium. (L4)
- Understand various bus bar schemes in substation. (L2)

<u>UNIT – IV</u> (9 Hrs)

Power Factor Improvement: Three Phase Balanced Primary Lines. Causes of Low P.F - Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

<u>UNIT – V</u> (9 Hrs)

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

TEXTBOOKS:

1. "Electric Power Distribution Engineering", Turan Gonen, CRC Press, 3rd Edition, 2014.
2. "Electric Power Distribution", A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

REFERENCE BOOKS:

1. "Electric Power Distribution Automation", Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010
2. "Electrical Power Distribution Systems", V. Kamaraju, Jain Book Depot, 2012.

Course Code	ROBOTICS		L	T	P	C
21A030501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control
- To choose and incorporate robotic technology in engineering systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the introduction and types of robots. **(K2)**

CO2: Analyze kinematics using forward and inverse kinematics and dynamics of robots using transformation, Jacobians, Lagrange – Euler and Newton – Euler formation. **(K4)**

CO3: Understand the working principle of different types of actuators and sensors. **(K2)**

CO4: Understand the motion types and robot programming software. **(K2)**

CO5: Know importance of robotic Applications in manufacturing. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	1	-	-	-	-	-	-	2	3	-
CO2	1	-	3	-	-	-	-	-	-	-	-	1	1	3
CO3	3	-	2	-	2	-	-	-	-	-	-	1	3	1
CO4	3	-	2	-	3	-	-	-	-	2	-	-	3	2
CO5	3	-	2	-	2	-	-	-	-	1	-	2	3	-

UNIT – I (8 Hrs)

Introduction to Industrial Robots: Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of robots. (L2)
- Differentiate types of robots and robot grippers. (L4)

UNIT – II (8 Hrs)

Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation-D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformation, Jacobians .Lagrange – Euler and Newton – Euler formations.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire the knowledge about robot kinematics and dynamics. (L2)

- Analyze the forward and inverse kinematics of robot manipulators. (L4)

UNIT – III (9 Hrs)
Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile sensors, Proximity sensors.
Learning Outcomes: At the end of this unit, students should be able to

- Identify the various types of robot actuators and feedback components. (L1)
- Understand the working of robot sensors. (L2)

UNIT – IV (11 Hrs)
Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion.
Robot programming - Types – features of languages and software packages.
Learning Outcomes: At the end of this unit, students should be able to

- Analyze motion in links and joints of a robot. (L4)
- Understand the types and software packages of robots. (L2)

UNIT – V (9 Hrs)
Robot Application in Manufacturing: Material Transfer -Material handling, loading and unloading - Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.
Learning Outcomes: At the end of this unit, students should be able to

- Express the various applications of robots in industries. (L2)
- Acquire the knowledge about real time applications of robots in manufacturing. (L2)

TEXTBOOKS:

1. "Industrial Robotics", M.P. Groover, TMH.
2. "Robotics, Fundamental Concepts and analysis", Ashitave Ghosal, Oxford Press
3. "Robotics and Control", Mittal R K & Nagrath I J, TMH.

REFERENCE BOOKS:

1. "Robotics", Fu K S, McGraw Hill.
2. "An Introduction to Robot Technology", P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. "Robotic Engineering", Richard D. Klafter, Prentice Hall
4. "Introduction to Robotics", John J. Craig, Pearson Edu
5. "Automation, Production systems and CIM", M.P. Groover, Pearson Edu

<table>
<tr><th>Course Code</th><th rowspan="2" colspan="2">BASICS OF MECHANICAL ENGINEERING</th><th>L</th><th>T</th><th>P</th><th>C</th></tr>
<tr><th>21A030502</th><th>3</th><th>0</th><th>0</th><th>3</th></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">V</td></tr>
</table>

COURSE OBJECTIVES:

- To familiarize students with basic power plants types, turbines, pumps, IC engines, boilers, refrigeration and air conditioning process and their performance aspects.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know types of power generating plants by using conventional or Non-conventional resources. **(K2)**

CO2: Understand and implementation of turbines, explain different types of pumps and their application. **(K2)**

CO3: Describe To familiarize the developments in IC engines. **(K2)**

CO4: Uunderstand the concept of the boilers. **(K2)**

CO5: Explain the working principles of refrigeration and air conditioning systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	2	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-	-	2	-	-

UNIT – I (10 Hrs)

Power Plant Engineering: Introduction – Energy Renewable and Non – Renewable Energy, Sources – Classification of Power Plants based on Sources of Energy – Thermal Power Plant or Steam Power Plant – Hydro Electric Power – Nuclear Fission, Chain Reaction, Layout of Nuclear Power Plant – Diesel Power Plant – Gas Turbine Power Plant – Open Cycle Gas Turbine, Closed Cycle Gas Turbine Power Plant, Comparison of Diesel Power Plant with Gas Turbine Power Plant.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the energy Renewable and Non – Renewable Energy Sources. (L2)
- Illustrate the working principle of Steam, Nuclear & open cycle, and closed cycle gas turbine. (L2)

UNIT – II (10 Hrs)

Hydraulic Turbine – Classification of Hydraulic Turbines, Impulse Turbine, Reaction Turbine, Difference between Impulse and Reaction Turbine.

Pumps – Classification of Pumps, Centrifugal Pump, Applications of Centrifugal Pump, Priming, Reciprocating Pumps, Single Acting Reciprocating Pump, Working of a Double acting Reciprocating Pump, Comparison of Reciprocating Pump with Centrifugal Pump.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Hydraulic Turbines, Impulse Turbine, and Reaction Turbine. (L2)
- Understand the working of Centrifugal Pump, Reciprocating Pumps and Comparison between them. (L2)

UNIT – III (10 Hrs)

I.C Engine: Heat Engine – Types of Heat Engine – External Combustion Engine, IC Engine (Internal Combustion), Classification of I.C. Engine, Two Stroke Petrol Engine, Four Stroke Engine, Valve Timing Diagram, Port Timing Diagram, Comparison of Two Stroke and Four Stroke Engines, Comparison of Petrol Engine and Diesel Engine, Fuel System of a Petrol Engine, Ignition Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of External Combustion Engine, IC Engine. (L2)
- Illustrate the working of Two Stroke Petrol Engine, Four Stroke Engine. (L2)

UNIT – IV (7 Hrs)

Boilers: Classification of Boilers – Simple Vertical Boiler – Cochran Boiler – Babcock and Wilcox Boiler – Benson Boiler – Difference between Fire Tube and Water Tube Boilers – Boiler Mountings – Boiler Accessories – Difference between Boiler Mountings and Accessories.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of different types Fire Tube and Water Tube Boilers.(L2)

UNIT – V (8 Hrs)

Refrigeration and Air Conditioning: Introduction – Terminology of Refrigeration and Air Conditioning – Properties of Refrigerants – List of Commonly used Refrigerants – Types of Refrigerating System – Vapour Compression Refrigeration System – Vapour Absorption Refrigerator – Domestic Refrigerator – Air Conditioning – Application of Air Conditioning –Psychrometry – Window Air Conditioning.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Vapour Compression Refrigeration System – Vapour Absorption Refrigeration system. (L2)
- Illustrate the working of Air Conditioning. (L2)

TEXTBOOKS:

1. "Basic Civil and Mechanical Engineering", Er. R. Vaishnavi, Prof. V. Vijayan, Prof. M. Prabhakaran, S. Chand Publication, 2^{nd} Edition
2. "Elements of Mechanical Engineering", S Trymbaka Murthy, University Press, 4^{th} Edition

REFERENCE BOOKS:

1. "Elements of Mechanical Engineering", S. N. Lal, Cengage Learning, 2013
2. "Elements of Mechanical Engineering", S. Trymbaka Murthy, Universities Press, 2015
3. "Mechanical Technology", Dr M. Maruthi Rao and V. Pavan Kumar, Lambert Academic Publishing, 2022

Course Code	INTEGRATED CIRCUITS AND APPLICATIONS		L	T	P	C
21A040501			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To introduce the basic building blocks of linear integrated circuits.
- To impart knowledge on linear and non-linear applications of Op-Amps.
- To design various circuits using Op-Amps.
- To familiarize with specialized ICs such as 555 timer and voltage regulators.
- To familiarize with digital ICs.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the construction and characteristics of Operational Amplifier IC **(K2)**
CO2: Explain various linear & non-linear applications of Op-amp **(K2)**
CO3: Develop knowledge on filters and describe internal circuit operation of 555 timer and voltage regulators ICs **(K3)**
CO4: Summarize combinational circuits using Digital integrated circuits **(K3)**
CO5: Explain the internal structure of sequential Digital integrated circuits **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	3	1	-
CO2	2	2	2	1	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	1	-	-	-	-	-	-	-	3	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	1	-

UNIT – I (8 Hrs)

INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER: Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of IC & classifications (L2)
- Understand the concepts of Operational amplifier. (L2)
- Illustrate the internal circuit of operational amplifier (L2)
- Analyze DC & AC characteristics of op-amp (L4)

UNIT – II (10 Hrs)

LINEAR APPLICATIONS OF OP-AMP: Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveformgenerators, Oscillators

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of integrator & differentiator circuits (L2)
- Understand the concepts of multivibrators and waveform generators (L2)
- Develop the output voltage expression for instrumentation amplifier (L3)
- Analyze the adder, subtractors, multiplier and divider circuits (L4)

UNIT – III (10 Hrs)

ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

TIMERS AND REGULATORS: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, Introduction-Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on 1st and 2nd order active filters. (L3)
- Understand the functionality of 555 timer. (L2)
- Understand the internal structure and functionality of voltage regulators (L2)

UNIT – IV (8 Hrs)

COMBINATIONAL CIRCUITS USING TTL 74XX ICS: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7- segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).

Learning Outcomes: At the end of this unit, students should be able to

- Develop knowledge on the working of various combinational circuit ICs. (L3)
- Develop higher order combinational circuits from lower order Combinational ICs. (L3)

UNIT – V (9 Hrs)

SEQUENTIAL CIRCUITS USING TTL 74XX ICS: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493), Memory -SRAM & DRAM.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of sequential circuits using TTL ICs. (L2)

- Develop higher order Sequential circuits from lower order Sequential ICs. (L3)

TEXTBOOKS:

1. “Linear Integrated Circuit”, D. Roy Choudhury, Shail B. Jain, New Age International Pvt.Ltd., New Delhi, India, 4th Edition, 2012
2. “OP-AMP and Linear Integrated Circuits”, Ramakant A. Gayakwad, Prentice Hall / Pearson Education, New Delhi, 4th Edition, 2012
3. “Digital Fundamentals”, Floyd, Jain, Pearson Education, New Delhi, 8th Edition, 2009.

REFERENCE BOOKS:

1. “Design with operational amplifiers and analog integrated circuits”, Sergio Franco McGrawHill, New Delhi, 1997
2. “Digital Design Principles and Practices”, John F Wakerly, Pearson Education, 4th Edition

<table>
<tr><td>Course Code</td><td rowspan="2">INTRODUCTION TO SIGNAL PROCESSING</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>21A040502</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>NIL | Semester</td><td colspan="4">V</td></tr>
</table>

COURSE OBJECTIVES:

- To understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- To represent continuous time signals (both periodic and non-periodic) in the time domain, s-domain and the frequency domain.
- To understand the properties of analog filters, and have the ability to design Butterworth filters.
- To understand and apply sampling theorem and convert a signal from continuous time to discrete time and able to represent the discrete time signal in the frequency domain.
- To understand FIR and IIR filters to meet given specifications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain continuous time and discrete time signals and systems, in time and frequency domain. **(K3)**

CO2: Apply Fourier series and Fourier Transform to analyze periodic & non-periodic signals and their spectra. **(K3)**

CO3: Design and implement the analog filter using components/suitable simulation tools. **(K4)**

CO4: Apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time. **(K3)**

CO5: Design and implement the digital filter using suitable simulation tools. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction to Signals & Systems: Signal Definition, Signal Classification, System definition, System classification for both continuous time and discrete time, Basic Operations on Signals, Elementary Signals & Sequences, Definition of LTI systems, Transfer function of a LTI system, Concepts of Convolution and Correlation of signals, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different basic types of signals and systems. (L2)
- Understand various basic operations on signals and elementary signals. (L2)

- Describe continuous time signal and discrete time signal. (L2)
- Sketch the various types of basic signals for both continuous time & discrete time. (L3)
- Understand the LTI systems, convolution & correlation of signals. (L2)

UNIT – II (10 Hrs)

Fourier Series & Transform: Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems, Fourier Transform of arbitrary signal, Properties of Fourier Transform, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the periodic signals by applying Fourier series. (L4)
- Apply Fourier transform to solve problems. (L3)
- Analyze the spectral characteristics of signals. (L4)

UNIT – III (8 Hrs)

Analog Filters: Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of analog filters. (L2)
- Design and implement the analog Butterworth filters. (L4)

UNIT – IV (8 Hrs)

Sampling Theorem & DFT: Sampling Theorem- Statement and proof, converting the analog signal to a digital signal, Practical sampling, The Discrete Fourier Transform, Properties of DFT, IDFT, Comparing the frequency response of analog and digital systems, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of sampling techniques. (L2)
- Illustrate signal sampling and its reconstruction. (L3)
- Explain the importance of discrete Fourier transform. (L3)

UNIT – V (10Hrs)

Digital Filters: Characteristics of FIR and IIR filters. Frequency response of ideal digital filters, Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, Comparison of FIR & IIR, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of IIR and FIR digital Filters. (L2)
- Analyze windowing techniques in FIR filters. (L4)
- Illustrate the digital filters of different techniques. (L3)

- Design IIR and FIR filters. (L4)

TEXTBOOKS:

1. "Signals, Systems and Communications", B. P. Lathi, BS Publications, 2008.
2. "Digital signal processing, principles, Algorithms and applications", John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 4th Edition, 2007.
3. "Discrete Time Signal Processing", A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

REFERENCE BOOKS:

1. "Linear Systems and Signals", B. P. Lathi, Oxford University press, 2nd Edition.
2. "Digital Signal Processing – Fundamentals and Applications", Li Tan, Elsevier, 2008.
3. "Signals, Systems and Transforms", C. L. Philips, J. M. Parr and Eve A. Riskin, PE, 3rd Edition, 2004.
4. "Signals and Systems", A.V. Oppenheim, A.S. Willsky and S. H. Nawab, PHI, 2nd Edition, 2013.
5. "Signals and Systems", A. Anand Kumar, PHI Publications, 3rd Edition, 2013.

OPEN ELECTIVE – II

Course Code	ENVIRONMENTAL POLLUTION AND CONTROL		L	T	P	C
21A010502			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart knowledge on aspects of air pollution & control and noise pollution.
- To impart concepts of treatment of waste water from industrial source.
- To differentiate the solid and hazardous waste based on characterization.
- To introduce sanitation methods essential for protection of community health.
- To provide basic knowledge on sustainable development.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the fundamentals of solid waste management, practices adopted in his town / village and its importance in keeping the health of the city. **(K2)**

CO2: Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards**. (K2)**

CO3: Differentiate the treatment techniques used for sewage and industrial wastewater Treatment. **(K3)**

CO4: Integrate the methods of environmental sanitation and the management of community facilities without spread of epidemics. **(K6)**

CO5: Appraise the importance of sustainable development while planning a project or executing an activity. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

AIR POLLUTION:

Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

Learning Outcomes: At the end of this unit, students should be able to

- Understand control mechanism of air pollutants. (L2)
- Design noise reduction techniques. (L6)

UNIT – II (9 Hrs)

INDUSTRIAL WASTE WATER MANAGEMENT:

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of treatment process of industrial effluents. (L2)
- Design treatment plants. (L6)

UNIT – III (9 Hrs)

SOLID WASTE MANAGEMENT: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

HAZARDOUS WASTE: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Learning Outcomes: At the end of this unit, students should be able to

- Categorize of solid waste and separation and procession solid waste. (L4)
- Estimate Hazardous wastes. (L5)
- Develop execute solid waste and hazardous waste management. (L6)

UNIT – IV (9 Hrs)

ENVIRONMENTAL SANITATION: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of hygienic environment. (L2)
- Choose appropriate rural sanitation methods to keep surrounding clean. (L5)

UNIT – V (9 Hrs)

SUSTAINABLE DEVELOPMENT: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability– Industrialization and sustainable development – Cleaner production in achieving sustainability-sustainable
development.

Learning Outcomes: At the end of this unit, students should be able to

- Express sustainable development strategies. (L6)

TEXTBOOKS:

1. "Environmental Engineering", Peavy, H. S., Rowe, D.R, Tchobanoglous, Mc-Graw Hill International Editions, New York 1985.
2. "Environmental Science and Engineering", J. G. Henry and G. W. Heinke, Pearson Education.

REFERENCE BOOKS:

1. "Waste water treatment- concepts and design approach", G. L. Karia and R.A. Christian, Prentice Hall of India
2. "Air pollution", M. N. Rao and H. V. N. Rao, Tata Mc.Graw Hill Company.
3. "Weiner and Robin Matthews Environmental Engineering", Ruth F., Elesevier, 4th Edition, 2003.
4. "Air Pollution and Control", K. V. S. G. Murali Krishna, Kousal & Co. Publications, New Delhi.

Course Code	SMART GRID		L	T	P	C
21A020503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Impart knowledge on relevance smart grids technologies, its potential challenges and applications to the real world.
- Provide deeper insight on the customer's needs and consumption pattern for better load management and forecasting.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operational and functional aspects of smart grid, architecture and technical challenges. **(K2)**

CO2: Analyze the communication signals from various measuring units and sub-networks for monitoring secured operation adhering relevant standards. **(K4)**

CO3: Assess the various energy options and apply them for the sustainability of Smart grid. **(K2)**

CO4: Develop strategies for demand side management using various communication protocols. **(K3)**

CO5: Understand the challenges and relevant standards in interoperability and cyber security of Smart grid. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to Smart Grid: Introduction to smart grid as per National Institute Standards and Technology (NIST), smart grid architecture, functions of smart grid components, smart grid initiatives in India, technology drivers and challenges. Overview of the technologies required for smart grid and architecture of smart substation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concept of smart grid Technology. (L2)
- Explain Smart grid functions. (L3)
- Understand Smart grid architecture. (L2)

UNIT – II (9 Hrs)

Smart Grid Measurement Technology: Introduction, standards for information exchange, monitoring, smart meters, and measurement technologies, WAMS, PMUs, GIS and google mapping tools and multi-agent systems technology.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the measurement technologies. (L2)
- Explain the google mapping tools. (L3)
- Compare WAMS and PMU. (L3)

UNIT – III (9 Hrs)

Sustainable Energy Options for the Smart Grid: Renewable Energy Resources, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, Storage Technologies.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of Renewable energy source. (L3)
- Understand basic concept of Electric Vehicles. (L2)

UNIT – IV (9 Hrs)

Demand Side Management and Communication Technology: Introduction, Demand Side Management objectives and its classification. Communication technologies: IEEE 802X series. Layouts of Sub-networks: LAN, WAN, NAN, HAN and FAN and its comparison.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic concepts of management objectives. (L3)
- Compares the WAN, LAN, NAN, HAN. (L3)

UNIT – V (9 Hrs)

Interoperability, Standards and Cyber Security : Introduction, State-of-the-Art-Interoperability, Benefits and Challenges of Interoperability, Model for Interoperability in the Smart Grid Environment, Smart Grid Network Interoperability, Interoperability and Control of the Power Grid, Standards, Approach to Smart Grid Interoperability Standards, Smart Grid Cyber Security, Cyber Security State of the Art, Cyber Security Risks, cyber security concerns associated with Advanced Metering Infrastructure, Mitigation approach to cyber security risks.

Learning Outcomes: After successful completion of this unit, the students will be able to

- Understand basic Benefits and Challenges of Interoperability. (L2)
- Analyze Smart Grid Network Interoperability. (L4)

TEXTBOOKS:

1. "Smart Grid: Fundamentals of design and analysis", James Momoh, John Wiley & sons Inc, IEEE press, 2012

2. “Smart Grid: Technology and Applications”, Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons Inc., 2012.

REFERENCE BOOKS:

1. “Smart Grid: Integrating Renewable, Distributed & Efficient Energy”, Fereidoon P. Shoshonis, Academic Press, 2012
2. “The smart grid: Enabling energy efficiency and demand response”, Clark Grellings, Fairmont Press Inc, 2009.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/107/108107113/
2. https://smartgrid.ieee.org/resources/webinars

Course Code	ENERGY STORAGE SYSTEMS		L	T	P	C
21A020504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need for energy storage
- Understand about the fundamentals of ESS
- Know about types, features and benefits of ESS
- Know about various management and control including market potential of ESS
- Study about various applications of ESS

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: To get exposed to latest technology of ESS. **(K3)**

CO2: Understand the principle, features, and benefits of ESS. **(K2)**

CO3: Understand the marketing and management strategies of ESS in working environment. **(K2)**

CO4: Distinguish wide variety of applications of EES for practical applications. **(K2)**

CO5: Know about latest technology applications of Battery SCADA, which is going to be vital in future applications, trend in new and renewable energy source. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Fundamentals of ESS: Definitions, Characteristics of ESS, Electricity, and roles of ESSs, Emerging needs in ESS, Classification of ESSs, Roles of Electrical storage technologies.

Learning Outcomes: At the end of this unit, students should be able to

- To know about the fundamentals of ESS. (L4)
- To know about emerging needs and roles of ESS. (L4)
- To know about various classifications of ESS. (L4)
- To understand about roles of energy storage technologies. (L2)

UNIT – II (9 Hrs)

Types and Features of ESS Technologies: Mechanical storage systems, Electromechanical

storage systems, Chemical energy storage, Electrical storage systems, Thermal storage systems, standards for EES, Comparison of ESS technology storage systems, Power and discharge duration, Energy and power density, Storage operating cost, Power quality, Reactive power capability.

Learning Outcomes: At the end of this unit, students should be able to

- To understand about various types of ESS technologies. (L2)
- To understand about standards for ESS. (L2)
- To learn about power and discharge duration of ESS. (L2)
- To know about preliminaries of ESS operating cost. (L4)
- To understand about power quality issues and reactive power capability of ESS. (L2)

UNIT – III (9 Hrs)

Storage Benefits: Definitions, Applications, specifications, benefits, Electric energy time shift, Electric supply capacity, reserve capacity, voltage support, Electric service power quality and reliability, Incidental benefits, energy losses, access charges, Risk, dynamic operating benefits, p.f. correction, reduced air emissions, flexibility, energy benefits.

Learning Outcomes: At the end of this unit, students should be able to

- To know various storage benefits. (L4)
- To distinguish between application specific benefits and identical benefits. (L2)
- To understand about electric service power quality and reliability issues. (L2)
- To learn about energy benefits from storage systems. (L3)

UNIT – IV (9 Hrs)

EES Market and Management: Utility and Consumer use, Measurement and Control hierarchy, Internal configurations, External connections, Battery SCADA, Market potential, estimation, role of aggregators, Maximum market potential estimates, Demand change management, Time-of-use energy cost management, storage modularity.

Learning Outcomes: At the end of this unit, students should be able to

- To understand about management of ESS technologies. (L2)
- To distinguish between internal and external configuration of ESS. (L2)
- To know about battery SCADA system and storage modularity. (L4)
- To distinguish between demand change and time-of-use energy cost management. (L2)

UNIT – V (9 Hrs)

Applications of EES: Power Vs Energy, Capacity Vs energy applications, specific power and discharge durations, Electric supply applications, ancillary service applications, End user/utility customer applications, Distributed energy storage applications, Locational, Non-locational and incidental applications.

Learning Outcomes: At the end of this unit, students should be able to

- To know about various ESS. (L4)
- To distinguish between power, capacity, energy applications of ESS. (L2)
- To distinguish between electric supply and ancillary applications. (L2)
- To understand about the importance of distributed energy storage applications. (L2)

TEXTBOOKS:

1. "Energy Storage Benefits and Market Analysis", James M. Eyer, Joseph J. Iannucci and Garth P. Corey, Sandia National Laboratories, 2004
2. "The Electrical Energy Storage", IEC Market Strategy Board, White paper.

REFERENCE BOOKS:

1. "Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide", Jim Eyer, Garth Corey, Sandia National Laboratories", Feb 2010.

Course Code	AUTOMATION IN INDUSTRIES		L	T	P	C
21A030503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need of automation
- Classify various types of automated transmission lines and components of automation.
- List and understand various material handling systems.
- Design various types of automated assembly systems
- Explain various automatic inspection systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand principles and basic elements of automation. **(K2)**
CO2: Understand the Detroit automation and automated flow lines. **(K2)**
CO3: Learn the material handling technology and assembly systems. **(K1)**
CO4: Learn the control systems technology and its process in automation. **(K1)**
CO5: Understand the inspection, testing and PLC's in automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	3	1	2	1	-	-	-	-	-
CO2	3	-	-	-	2	2	1	-	2	-	-	-	-	-
CO3	3	-	-	-	1	1	1	-	1	-	-	-	-	-
CO4	2	2	3	-	3	2	2	-	2	-	-	-	-	-
CO5	2	-	-	-	2	1	2	-	1	-	-	-	-	-

UNIT – I (9 Hrs)

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break-Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in process.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the principles of production, investment, cost concepts in automation. (L2)

UNIT – II (10 Hrs)

Detroit-Type Automation: Automated Flow lines, Methods of Work-part Transport, Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations.

Analysis of Automated Flow Lines: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the types of automation method concepts and machining operations. (L2)

UNIT – III (11 Hrs)

Material handling and Identification Technologies: The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc.

Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multistation Assembly Machines, Analysis of a Single Station Assembly Machine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Apply the techniques of material handling and automated assembly systems. (L4)

UNIT – IV (7 Hrs)

Control Technologies in Automation: Industrial Control Systems, Process Industries Verses Discrete- Manufacturing Industries, Continuous Verses Discrete Control, Computer Process Control and its Forms. Computer Based Industrial Control: Introduction & Automatic Process Control, Building Blocks of Automation System: LAN, Analog & Digital I/O Modules, SCADA System & RTU.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the industrial control technologies in automation. (L2)

UNIT – V (8 Hrs)

Automated Inspection and Testing: Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods.

Programmable Logic Controllers (PLCs): Introduction, Micro PLC, Programming a PLC, Logic Functions, Input & Output Modules, PLC Processors, PLC Instructions, Documenting a PLC System, Timer & Counter Instructions, Typical PLC Programming Exercises for Industrial Applications.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain the inspection, testing methods and PLC's methods in automation. (L2)

TEXTBOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing", M. P. Grover, Pearson Education.

REFERENCE BOOKS:

1. "Computer Based Industrial Control", Krishna Kant, EEE-PHI
2. "Principles and Applications of PLC", Webb John, Mcmillan 1992
3. "An Introduction to Automated Process Planning Systems", Tiess Chiu Chang & Richard A. Wysk
4. "Anatomy of Automation", Amber G.H & P.S. Amber, Prentice Hall.

Course Code	RAPID PROTOTYPING		L	T	P	C
21A030504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- The fundamental Theory behind RP process.
- Study the Process parameters of different machine.
- Study different types of Rapid tooling.
- Based on the industrial standards, learn how Prepare manufacturing DATA.
- The basics concept of different software used in RP system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Theory behind RP process. **(K2)**
CO2: Learn the Process parameters of different machine. **(K3)**
CO3: Learn different types of Rapid tooling. **(K3)**
CO4: Understand the industrial standards; learn how to prepare manufacturing Data. **(K2)**
CO5: Understand basics concept of different software used in RP system. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	2	3	1	2	-	-	1	-	-	-	-
CO2	2	2	-	3	2	2	2	-	-	1	-	-	-	-
CO3	3	2	-	3	2	1	3	-	-	1	-	-	-	-
CO4	1	2	-	3	3	1	3	-	-	1	-	-	-	-
CO5	1	2	-	3	3	1	3	-	-	1	-	-	-	-

UNIT – I (9 Hrs)

Introduction & History of Rapid Prototyping, Fundamentals of Rapid Prototyping, Advantages and Disadvantages of Rapid Prototyping, Applications of Rapid Prototyping, Classification of RP, Rapid prototyping process chain, Fundamental Automated processes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know about the importance of rapid prototyping. (L1)
- Understand the concept of Stereo lithography. (L2)

UNIT – II (9 Hrs)

Stereo lithography (SLA) system & principle, Process parameter, process details of SLA, Data preparation, data files of SLA, Machine details & Application of SLA.

Selective Laser Sintering (SLS)- Introduction, SLS Machine Type – Details, SLS principle of operation, Process parameters of SLS, Data preparation for SLS.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about the selective laser sintering process. (L4)
- Explain about the concept of fused deposition modelling and solid ground curing. (L2)

UNIT – III (7 Hrs)

Fused Deposition Modeling (FDM) – Introduction, FDM Principles, Process Parameters, Path generation & Application of FDM, Solid Ground curing (SGC) - Principle of operation, SGC machine details & application. Laminate Object Manufacturing (LOM) - Principle of operation, LOM materials, LOM Process details & Application.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Demonstrate about laminated object manufacturing process. (L2)
- Know about different 3D modelling printing techniques. (L1)

UNIT – IV (10 Hrs)

Rapid tooling -Indirect rapid tooling, Silicon Rubber tooling, Aluminium filling epoxy tooling, Spray metal tooling, Direct rapid tooling, Quick cast process, copper Polyamide, DMILS – explanation, Prometals, sand casting tooling, Soft tooling & hard tooling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of rapid tolling. (L2)

UNIT – V (10 Hrs)

Rapid Manufacturing – Introduction, Factors influencing accuracy, Data preparation errors, Part building errors, Errors in finishing, Influence of build orientation.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand different file format software's of 3D modelling techniques. (L2)

TEXTBOOKS:

1. "Stereo lithography and other RP & M Technologies", Paul F. Jacobs, SME, NY 1996.
2. "Rapid Manufacturing", Flham D. T & Dinjoy S.S, Verlog London 2001.
3. "Rapid automated", Lament wood, Indus press New York.

REFERENCE BOOKS:

1. "Wohler's Report 2000", Terry Wohlers, Wohler's Association, 2000.
2. "Rapid prototyping materials", Gurumurthi, IISc Bangalore

Course Code	PRINCIPLES OF COMMUNICATION SYSTEMS		L	T	P	C
21A040503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concept of amplitude modulation to solve engineering problems. **(K3)**
CO2: Analyze the Angle modulation & demodulation systems in time & frequency domains. **(K4)**
CO3: Analyze different Analog Pulse modulation & demodulation techniques. **(K4)**
CO4: Explain various digital modulation schemes. **(K3)**
CO5: Understand the concept of various communication systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Amplitude Modulation: An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of noise, Fourier transform, career modulation and frequency division multiplexing. (L2)
- Apply the concept of amplitude modulation to solve engineering problems. (L3)

UNIT – II (9 Hrs)

Angle Modulation: Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of angle modulation and its components. (L2)
- Apply the concept of frequency modulation to solve engineering problems. (L3)
- Analyse angle modulation schemes. (L4)
- Evaluate frequency modulation scheme in real time applications. (L4)

UNIT – III (8 Hrs)

Pulse Modulation: Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing. (L2)
- Explain various pulse modulation schemes. (L4)

UNIT – IV (9 Hrs)

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various digital modulation schemes. (L2)
- Analyze various digital modulation schemes. (L4)

UNIT – V (9 Hrs)

Communication Systems: Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various communication systems. (L2)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. “Principles of Communication Systems”, Herbert Taub, Donald L Schilling and Goutam Saha, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

REFERENCE BOOKS:

1. “Modern Digital and Analog Communication Systems”, B. P. Lathi, Zhi Ding and Hari M. Gupta, 4th Edition, Oxford University Press, 2017.

2. "Digital and Analog Communication Systems", K. Sam Shanmugam, Wiley India Edition, 2008.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108104091
2. https://www.eeeguide.com/principles-of-communication-systems
3. https://ncert.nic.in/ncerts/l/leph207.pdf

Course Code	ELECTRONIC INSTRUMENTATION		L	T	P	C
21A040504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To introduce various measuring instruments and their functionality.
- To teach various measurement metrics for performance analysis.
- To explain principles of operation and working of different electronic instruments.
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.
- To provide exposure to different types of transducers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the different methods for measurement of various electrical quantities. **(K2)**
CO2: Compare the various measuring techniques for measuring voltage. **(K4)**
CO3: Measure amplitude and frequency utilizing oscilloscopes. **(K5)**
CO4: Analyze the functioning of various types of probes, derive the balanced condition for various bridges. **(K4)**
CO5: Measure various physical parameters by appropriately selecting the transducers. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (10 Hrs)

Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. **Ammeters:** DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. **Voltmeters and Multi-meters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of measurement system. (L2)
- Explain the characteristics of different Instruments. (L2)

- Illustrate different types of errors that may occur in instruments during measurements. (L2)

UNIT – II (9 Hrs)

Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM.

Digital Instruments: Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

Learning Outcomes: At the end of this unit, students should be able to

- Explain working of digital measuring Instruments. (L2)
- Compare the various measuring techniques for measuring voltage. (L4)

UNIT – III (9 Hrs)

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope.

Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator.

Learning Outcomes: At the end of this unit, students should be able to

- Measure parameters viz. Amplitude, frequency and time period using CRO. (L5)
- Classify signal generators and describe its characteristics. (L2)

UNIT – IV (8 Hrs)

Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger.

Bridges: Introduction, Wheatstone‘s bridge, Kelvin‘s Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell‘s bridge, Wien‘s bridge.

Learning Outcomes: At the end of this unit, students should be able to

- Describe function of various measuring Instruments. (L2)
- Describe how unknown capacitance and inductance can be measured using bridges. (L2)
- Select appropriate bridge for measuring R, L and C parameters. (L2)
- Analyze the functioning of various types of probes derive the balanced condition for various bridges. (L4)

UNIT – V (9 Hrs)

Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive

transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of transducer. (L2)
- Measure various physical parameters by appropriately selecting the transducers. (L5)

TEXTBOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, McGraw Hill, 3rd Edition, 2012, ISBN: 9780070702066.
2. "Modern Electronic Instrumentation and Measuring Techniques", A. D. Helfrick and W.D. Cooper, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

REFERENCE BOOKS:

1. "Electronic Instrumentation & Measurements", David A. Bell, Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.
2. "Electronics and Electrical Measurements", A. K. Sawhney, Dhanpat Rai &Sons. ISBN - 81-7700-016-0

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/108105064/
2. http://nptel.ac.in/courses/108105062/

OPEN ELECTIVE – III

Course Code	DISASTER MANAGEMENT AND MITIGATION		L	T	P	C
21A010503			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To obtain the basic knowledge of Environmental Hazards and disasters.
- To understand the basics of Endogenous and Exogenous hazards and gives a suitable picture on the different types of hazard and disaster mitigation methods.
- To understand the key concepts of disaster management related to development and the relationship of different disaster management activities.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze and evaluate the environmental, social, cultural, economic, legal and organizational Aspects influencing vulnerabilities and capacities to face disasters and to know about different types of environmental hazards. **(K4)**

CO2: Compute knowledge on different types of natural and man- made disasters. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery). **(K3)**

CO3: Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ. **(K3)**

CO4: Identify endogenous and exogenous hazards their harmful effects to the environment, Case studies of India. **(K1)**

CO5: Identify the regulatory controls used in hazard management. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO2	3	3	3	3	-	-	2	1	-	-	2	-	2	-
CO3	3	3	3	3	-	-	2	2	-	-	2	-	2	-
CO4	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO5	3	3	2	3	-	-	2	1	-	-	2	-	3	-

UNIT – I (8 Hrs)

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Learning Outcomes: At the end of this unit, students should be able to

- Debate on the Knowledge of the disaster phenomenon, its different contextual aspects, impacts and public health consequences. (L5)
- Express about the natural hazards and its management. (L6)

UNIT – II (10 Hrs)

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

Learning Outcomes: At the end of this unit, students should be able to

- Explain the Capacity to manage the Public Health aspects of the disasters. (L4)
- Distinguish the different types of environmental hazards & disasters. (L5)

UNIT – III (9 Hrs)

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the regulations of building codes and land use planning related to risk and vulnerability. (L4)
- Justify the financial management of disaster and related losses. (L6)

UNIT – IV (9 Hrs)

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods-Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Mitigation and control measures of exogenous hazards. (L2)
- Analyze, and communicate information on risks, relief needs and order to formulate strategies for mitigation. (L4)

UNIT – V (9 Hrs)

Soil Erosion: - Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion. Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation. Biological hazards/ disasters:- Population Explosion.

Learning Outcomes: At the end of this unit, students should be able to

- Relate their interconnections, particularly in the field of the Public Health aspects of the disasters. (L3)
- Understand different approaches to prevent disasters. (L2)

TEXTBOOKS:

1. "Disaster Management", Rajib Shah, Universities Press, India, 2003
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Disaster Mitigation: Experiences and Reflections", Pardeep Sahni
4. "Natural Hazards & Disasters", Donald Hyndman & David Hyndman, Cengage Learning.

REFERENCE BOOKS:

1. "The Environment as Hazards", Kates, B.I & White, G.F, Oxford Publishers, New York, 1978
2. "Disaster Management", R.B. Singh (Ed), Rawat Publication, New Delhi, 2000
3. "Disaster Management", H.K. Gupta (Ed), Universities Press, India, 2003
4. "Space Technology for Disaster Mitigation in India (INCED)", R.B. Singh, University of Tokyo, 1994.

ONLINE LEARNING RESOURCES:

1. http://ndma.gov.in
2. http://www.ndrf.gov.in

Course Code	RENEWABLE ENERGY SYSTEMS		L	T	P	C
21A020505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand various alternate sources of energy for different suitable application requirements. **(K2)**
CO2: Understand the concepts of solar energy generation strategies and wind energy system. **(K2)**
CO3: Analyze Solar and Wind energy systems. **(K4)**
CO4: Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass, and fuel cells. **(K2)**
CO5: Understand the fundamentals of Solar and Wind energy systems. **(K2)**

CO-POMAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

Learning Outcomes: At the end of this unit, students should be able to

- Understanding renewable and nonrenewable energy resources. (L2)
- Understand the various forms of conventional energy resources. (L2)
- Understanding of Solar power properties. (L2)

UNIT – II (8 Hrs)

PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the PV cells and modules. (L2)
- Disseminate information on PV. (L3)

UNIT – III (10 Hrs)

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

Learning Outcomes: At the end of this unit, students should be able to

- Understanding of wind energy production. (L2)
- Outline division aspects and utilization of renewable energy sources for both domestics and industrial application. (L3)
- Understand the need of Wind Energy and the various components used in energy generation and know the classification. (L2)

UNIT – IV (8 Hrs)

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the Resources of geothermal energy.(L2)

UNIT – V (10 Hrs)

Miscellaneous Energy Technologies: Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Biomass energy resources and their classification. (L2)
- Analyze the performance of Ocean Energy. (L4)

TEXTBOOKS:

1. "Renewable Energy Power for a Sustainable Future", Stephen Peake, Oxford International Edition, 2018.
2. "Non-Conventional Energy Sources", G. D. Rai, Khanna Publishers, 4th Edition, 2000.

REFERENCE BOOKS:

1. "Solar Energy", S. P. Sukhatme, Tata Mc Graw Hill Education Pvt. Ltd, 3rd Edition, 2008.
2. "Non-Conventional Energy Resources", B H Khan, Tata Mc Graw Hill Education Pvt Ltd, 2nd Edition, 2011.
3. "Non-Conventional Energy Resources", S. Hasan Saeed and D. K. Sharma, S. K. Kataria & Sons, 3rd Edition, 2012
4. "Renewable Energy Resource: Basic Principles and Applications", G. N. Tiwari and M. K. Ghosal, Narosa Publishing House, 2004

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

Course Code	CONCEPTS OF ELECTRICAL DRIVES AND APPLICATIONS		L	T	P	C
21A020506			**3**	**0**	**0**	**3**
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the choice of the electric drive system based on their applications. **(K2)**
CO2: Explain the operation of single and multi-quadrant electric drive. **(K3)**
CO3: Analyze single phase and 3-phase rectifiers fed DC motors and chopper fed DC motors. **(K4)**
CO4: Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors with closed loop, and open loop operations. **(K3)**
CO5: Explain the speed control methods for AC-AC & DC-AC converters fed to Synchronous motors with closed loop, and open loop operations. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Converter Fed DC Motors: Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase semi and fully controlled converters connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic electrical drive elements and its function. (L2)
- Analyze the single-phase dc drives and its speed-torque characteristics. (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – II (9 Hrs)

Four Quadrant Operation of DC Drives: Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the four-quadrant operation of the dc drives. (L2)
- Analyze the various motoring and braking operations of the dc motors. (L4)
- Understand the closed loop operation of the dc drives. (L2)

UNIT – III (9 Hrs)

Chopper fed DC Motors: Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics– Problems on Chopper Fed D.C Motors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basics concepts of choppers and its operation. (L2)
- Analyze the classification of various choppers feeding the dc drives. (L4)

UNIT – IV (9 Hrs)

Control of Induction Motor: Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers–Waveforms – Speed Torque Characteristics - Stator Frequency Control and characteristics. Voltage Source and Current Source Inverter – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Static Rotor Resistance Control

Learning Outcomes: At the end of this unit, students should be able to

- Understand the various speed control methods of induction motor used in drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods to induction motor on rotor side. (L3)

UNIT – V (9 Hrs)

Control of Synchronous Motors: Separate Control & Self Control of Synchronous Motors – Operation of Self-Controlled Synchronous Motors by VSI and CSI. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque Characteristics – Applications – Advantages.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the self and separate control methods of synchronous motor drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods of synchronous motors. (L4)

TEXTBOOKS:

1. "Power semiconductor-controlled drives", G K Dubey, Prentice Hall, 1995.
2. "Modern Power Electronics and AC Drives", B. K. Bose, PHI, 2002.

REFERENCE BOOKS:

1. "Power Electronics", MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. "Power Electronic Circuits, Devices and applications", M. H. Rashid, PHI, 2005.
3. "Electric drives Concepts and Applications", Vedam Subramanyam, Tata McGraw Hill Publications, 2nd Edition, 2011.

Course Code	OPTIMIZATION TECHNIQUES		L	T	P	C
21A030505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the basic fundamentals of optimization methods that can be used during a design process.
- To expose the students to different modern optimization techniques.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand basic theoretical principles of optimization models and its solution. **(K2)**
CO2: Formulate the given practical problem and solving by graphical /simplex method. **(K3)**
CO3: Analyse the cost for transportation and assigning the jobs to machines. **(K3)**
CO4: Analyse the cost and duration of the project, also preparation of job scheduling. **(K3)**
CO5: Use latest methods for optimization. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	1	2	2	1	-	-
CO2	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO3	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO4	3	3	3	3	-	2	-	1	1	-	2	1	-	-
CO5	3	3	3	3	2	2	-	-	2	-	2	1	-	-

UNIT – I (10 Hrs)

Introduction to Optimization: Classification of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems.

Classical Optimization Techniques: Single variable optimization, Multi-variable: Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain how to formulate statement of optimization problem with or without constraints. (L3)
- Explain about classification of single and multivariable optimization problems. (L3)
- Know about necessary and sufficient conditions in defining the optimization problems. (L1)
- Understand how to formulate Kuhn-Tucker conditions and to solve numerical problems. (L3)

UNIT – II (8 Hrs)

Linear Programming: Statement of an LP problem, Graphical Solution of an LP problem, Simplex method, Two phase method, Dual simplex method.

Learning Outcomes: At the end of this unit, students should be able to

- Formulation of problem as LPP. (L4)
- Solve numerical problems with graphical method, Simplex method, two phase method and dual simplex method. (L4)

UNIT – III (9 Hrs)

Transportation Problems: Introduction, Optimal Solution for BFS, Unbalanced Transportation Problem, Transshipment, Assignment Problems, Hungarian Method.

Learning Outcomes**:** At the end of this unit, students should be able to

- Model linear programming problems like the transportation. (L6)
- Solve the problems of transportation from origins to destinations with minimum time and cost. (L3)
- Solve assignment problems. (L4)

UNIT – IV (10 Hrs)

Project Management: Introduction, Critical Path Method, Critical Path Determination, Optimal Scheduling by CPM, Project Evaluation and Review Technique.

Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

Learning Outcomes: At the end of this unit, students should be able to

- Represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project. (L4)
- Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability. (L4)
- Solve problems of production scheduling. (L3)

UNIT – V (8 Hrs)

Modern Methods of Optimization: An overview of evolutionary algorithms, Genetic algorithms, simulated annealing, fuzzy optimization, neural-network based methods, Particle swarm optimization.

Learning Outcomes**:** At the end of this unit, students should be able to

- Solve the numerical problems using modern optimization techniques. (L4)

TEXTBOOKS:

1. "Engineering Optimization- Methods and Applications", A. Ravindran, K. M. Ragsdell, G.V. Reklaitis, Wiley India Edition, 2nd Edition.
2. "Operations Research: An Introduction", H.A. Taha, PHI Pvt. Ltd., 6th Edition

REFERENCE BOOKS:

1. "Introduction to Optimum Design", J S Arora, Mc-Graw Hill.
2. "Optimization Methods for Engineering Design", Fox, R. L., Addison Wesley, 2001.
3. "Multi-objective optimization using evolutionary algorithms", K Deb John Wiley Publications.
4. "Operations Research", Dr. J. K. Sharma, Mc Millan.
5. "Engineering Optimization: Theory and Practice", Singiresu S. Rao, John Wiley & Sons

Course Code	GLOBAL WARMING AND CLIMATE CHANGES		L	T	P	C
21A030506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To know the basics, importance of global warming.
- To know the concepts of mitigation measures against global warming
- To know the impacts of climate changes

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know the impact of Ozone layer on green house effect and global warming. **(K1)**
CO2: Understand the structure of atmosphere and effects of inversion on pollution dispersion. **(K2)**
CO3: Know the effect of global warming and climatic changes on environment. **(K1)**
CO4: Understand Global change in temperature and climate and measures to reduce the effect. **(K2)**
CO5: Understand the clean technology, use of renewable energy, mitigation technologies and their practices **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO5	1	2	-	2	-	-	-	-	2	-	-	2	-	-

UNIT – I (7 Hrs)

EARTH'S CLIMATE SYSTEM:

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Green house gases and green house effect, Hydrological cycle and Carbon cycle, Global warming and its impacts

Learning Outcomes: At the end of this unit, students should be able to

- Identity the importance of Ozone and effect of green house gases. (L1)
- Know the effect of global warming. (L1)

UNIT – II (9 Hrs)

ATMOSPHERE & ITS COMPONENTS: Atmosphere and its layers-Characteristics of Atmosphere - Structure of Atmosphere - Composition of Atmosphere - Atmospheric stability -

Temperature profile of the atmosphere - Temperature inversion and effects of inversion on pollution dispersion.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the layers of atmosphere and their characteristics. (L1)

UNIT – III (8 Hrs)

IMPACTS OF CLIMATE CHANGE: Causes of Climate change - Change of Temperature in the environment - Melting of ice and sea level rise - Impacts of Climate Change on various sectors - Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and its effects on various sectors. (L1)

UNIT – IV (10 Hrs)

OBSERVED CHANGES AND ITS CAUSES: Climate change and Carbon credits-Clean Development Mechanism (CDM), CDM in India - Kyoto Protocol - Intergovernmental Panel on Climate Change (IPCC) - Climate Sensitivity - Montreal Protocol - United Nations Framework Convention on Climate Change (UNFCCC) - Global change in temperature and climate and changes within India

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and carbon credits, effect of change in temperature and climate on India. (L1)

UNIT – V (11 Hrs)

CLIMATE CHANGE AND MITIGATION MEASURES: CDM and Carbon Trading - Clean Technology, biodiesel, compost, biodegradable plastics - Renewable energy usage as an alternative - Mitigation Technologies and Practices within India and around the world - Non-renewable energy supply to all sectors - Carbon sequestration - International and regional cooperation for waste disposal biomedical wastes, hazardous wastes, e-wastes, industrial wastes, etc.,

Learning Outcomes: At the end of this unit, students should be able to

- Know about the clean technology, use of renewable energy, mitigation technologies and their practices. (L1)

TEXTBOOKS:

1. “Climate Change – An Indian Perspective”, Dash Sushil Kumar, Cambridge University Press India Private limited 2007.

REFERENCE BOOKS:

1. "Adaptation and mitigation of climate change-Scientific Technical Analysis", Cambridge University Press, Cambridge, 2006.
2. "Atmospheric Science", J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3. "Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Jan C. van Dam, Cambridge university press, 2003.
4. "Global Warming: Understanding the Forecast"", David Archer, Wiley, 2nd Edition, 2011
5. "Global Warming: The Complete Briefing", John Houghton, Cambridge University Press, 5th Edition, 2015

Course Code	ELECTRONIC SENSORS		L	T	P	C
21A040505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To learn the characterization of sensors.
- To know the working of Electromechanical, Thermal, Magnetic and radiation sensors
- To understand the concepts of Electro analytic and smart sensors
- To be able to use sensors in different applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the Principles of different sensors, Characterization and working of Electro mechanical Sensors. **(K3)**
CO2: Analyze the working of Thermal sensors. **(K4)**
CO3: Compare the working of magnetic resistor and hall effect sensors. **(K4)**
CO4: Explain the working of radiation and Electro analytic Sensors. **(K3)**
CO5: Develop a system with smart sensors. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (9 Hrs)

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of sensors/Transducers principles. (L2)
- Understand the concepts of Electro mechanical sensors. (L2)
- Identify the operation of Inductive and capacitive sensors. (L3)

UNIT – II (9 Hrs)

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Thermal sensors. (L2)
- Understand the working of Thermal radiation sensors. (L2)
- Identify the types of semiconductor sensors. (L3)
- Analyse the operation of heat flux sensors. (L4)

UNIT – III (9 Hrs)

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principles of Magnetic sensors. (L2)
- Summarize the concepts of Angular transducers. (L2)
- Compare the working of magnetic resistor and Hall effect sensors. (L4)

UNIT – IV (9 Hrs)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors, Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of radiation sensors. (L2)
- Summarize the types of photo detectors. (L2)
- Explain different electrodes and sensors. (L3)

UNIT – V (9 Hrs)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications, Introduction- On-board Automobile

Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of smart sensors. (L2)
- Summarize the applications of automation sensor. (L2)
- Develop different sensors used in the industries and manufacturing. (L3)

TEXTBOOKS:

1. "Sensors and Transducers", D. Patranabis, PHI Learning Private Limited., 2003.
2. "Introduction to sensors", John veteline, Aravind Raghu, CRC press, 2011

REFERENCE BOOKS:

1. "Sensors and Actuators", D. Patranabis, PHI, 2nd Edition, 2013.
2. "Make sensors", Tero Karvinen, Kimmo Karvinen and Ville Valtokari, Maker media, 1st Edition, 2014.
3. "Sensors handbook", Sabrie Soloman, TMH, 2nd Edition, 2009

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108147
2. http://www.nitttrc.edu.in/nptel/courses/video/101104066/101104066.html

Course Code	INTRODUCTION TO IMAGE PROCESSING		L	T	P	C
21A040506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce fundamentals of Image Processing.
- To expose various intensity transformations in spatial and frequency domains.
- To impart concepts of wavelets and various coding techniques for image compression.
- To dissimilate various segmentation techniques for images.
- To teach various color models and to introduce the concepts of color image segmentation.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various types of images mathematically. **(K4)**
CO2: Compare image enhancement methods in spatial and frequency domains. **(K3)**
CO3: Apply various segmentation algorithms for processing an image. **(K3)**
CO4: Categorize various compression techniques and color models. **(K4)**
CO5: Apply various techniques for color image smoothing, sharpening and segmentation. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO4	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels: neighbourhood, adjacency, connectivity, distance measures. Mathematical tools/ operations applied on images.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic building blocks of image processing. (L2)
- Define image processing parameters such as adjacency and distance measures. (L1)
- Analyze various types of images mathematically. (L4)

UNIT – II (9 Hrs)

Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain

sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Learning Outcomes: At the end of this unit, students should be able to

- Apply spatial domain and frequency Domain filtering techniques for image enhancement (L3)
- Compare image enhancement methods in spatial and frequency domains. (L3)

UNIT – III (9 Hrs)

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various Image segmentation techniques. (L2)
- Illustrate detection of discontinuities in an image. (L2)
- Apply various segmentation algorithms for processing an image. (L3)

UNIT – IV (9 Hrs)

Image Compression: Redundancy, inter-pixel and psycho-visual; Loss less compression-predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various transform techniques for lossy compression. (L2)
- Apply various coding techniques for lossless compression. (L3)

UNIT – V (9 Hrs)

Color Image Processing: Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various color models for color image processing. (L2)
- Apply various techniques for color image smoothing, sharpening and segmentation. (L3)

TEXTBOOKS:

1. "Digital Image Processing", R.C. Gonzalez and R.E. Woods, Pearson Education, 2nd Edition, 2008.
2. "Fundamentals of Digital Image Processing", Anil Kumar Jain, Prentice Hall of India, 2nd Edition 2004.

REFERENCE BOOKS:

1. "Digital Image processing using MATLAB", Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Tata McGraw Hill, 2010.
2. "Image Processing, Analysis, and Machine Vision", Milan Sonka, Vaclav Hlavac, Roger Boule, Cengage Learning, 3rd Edition, 2016.
3. "Digital Image processing", S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.
4. "Digital Image Processing", William K. Pratt, John Wiley, 3rd Edition, 2004.

ONLINE LEARNING RESOURCES:

1. https://www.udemy.com/course/learn-image-analysis/
2. https://alison.com/tag/image-processing
3. https://nptel.ac.in/courses/117/105/117105135/

OPEN ELECTIVE – IV

Course Code	COST EFFECTIVE HOUSING TECHNIQUES		L	T	P	C
21A010504			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To train the students to have a comprehensive knowledge of planning, design, evaluation, construction
- To train the students to financing of housing projects
- To Provide Knowledge on cost effective construction materials and methods.
- To teach the principles of sustainable housing policies and programmes.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand about planning, design, evaluation, construction and financing of housing projects with cost effective housing techniques. **(K2)**

CO2: Choose the basic housing programmes and services and slum improvement and relocation. **(K3)**

CO3: The student can be in a position to adopt the suitable techniques in construction of low cost constructions. **(K6)**

CO4: Understand about alternate building materials for low cost housing techniques and sanitation services in rural areas. **(K2)**

CO5: The student can be in a position to analyze the suitable techniques in rural and disaster prone areas by using locally available materials. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

INTRODUCTION TO HOUSING: Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the about basics about housing norms. (L4)

- Understand the objectives and strategies of housing policies. (L2)

<u>UNIT – II</u> (9 Hrs)

HOUSING PROGRAMMES: Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate the usage of GIS and MIS in housing projects. (L4)
- Explain about development of plots and gated communities. (L4)

<u>UNIT – III</u> (9 Hrs)

DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY: Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements - Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall - Fly ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

Learning Outcomes: At the end of this unit, students should be able to

- Write about the adoption of Economical Wall System. (L6)
- Write about Adoption of precast R.C. plank and join system for roof/floor in the building. (L6)

<u>UNIT – IV</u> (9 Hrs)

ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING AND INFRASTRUCTURE SERVICES IN RURAL HOUSES: Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Low cost Infrastructure services: Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy. Rural Housing**:** Introduction traditional practice of rural housing continuous - Mud Housing technology-Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs.

Learning Outcomes: At the end of this unit, students should be able to

- Determine about alternate building materials for low cost housing construction. (L3)

- Justify about low cost sanitation from traditional methods. (L6)

UNIT – V (9 Hrs)

HOUSING IN DISASTER PRONE AREAS: Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirements of structural safety of thin pre-cost roofing units against Earthquake forces -Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about Type of Damages and Railways of non-engineered buildings. (L4)
- Express about Repair and restore action of earthquake Damaged structures and for future constructions. (L6)

TEXTBOOKS:

1. "Hand book of Low Cost Housing", A. K. Lal, New Age International publishers.
2. "Low Cost Housing", G.C. Mathur, IBH Publishers.
3. "Housing in India", Francis Cherunilam and Odeyar D Heggade, Himalaya Publishing House, Bombay, 1997.

REFERENCE BOOKS:

1. "Disaster Management", Rajib Shaw, Universities Press, India.
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Building Materials For Low–Income Houses", International Council For Building Research Studies And Documentation.
4. "Modern Trends In Housing In Developing Countries", A.G. Madhava Rao, D.S. Rama Chandra Murthy & G. Annamalai.
5. "Properties of Concrete"', Neville A.M. Pitman Publishing Limited, London.
6. "Light Weight Concrete", Academic Kiado, Rudhai.G, Publishing home of Hungarian Academy of Sciences, 1963.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/124107001
2. https://nptel.ac.in/courses/105103206
3. https://onlinecourses.nptel.ac.in/noc20_ar14/preview4

Course Code	ENERGY CONSERVATION AND MANAGEMENT		L	T	P	C
21A020507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Familiarize present energy scenario, and energy auditing methods.
- Explain components of electrical systems, lighting systems and improvements in performance. Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
- Train on energy conservation in major utilities.
- Instruct principles of energy management and energy pricing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain Energy Utilization and Energy Auditing Methods. **(K3)**
CO2: Analyse Electrical Systems Performance of Electric Motors and Lighting Systems. **(K4)**
CO3: Examine Energy Conservation Methods in Thermal Systems. **(K3)**
CO4: Estimate Efficiency of Major Utilities Such as Fans, Pumps, Compressed Air Systems, Havoc and D.G. Sets. **(K2)**
CO5: Elaborate Principles of Energy Management, Programs, Energy Demand and Energy Pricing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction: Energy – Power – Past & Present Scenario of World; National Energy Consumption Data – Environmental Aspects Associated with Energy Utilization –Energy Auditing: Need, Types, Methodology And Barriers. Role of Energy Managers, Instruments for energy auditing.

Learning Outcomes: At the end of this unit, students should be able to

- Infer energy consumption patterns and environmental aspects of energy utilization. (L4)
- Outline energy auditing requirements, tools, and methods. (L3)
- Identify the function of energy manager. (L2)

<u>UNIT – II</u> (9 Hrs)

Electrical Systems: Components of EB Billing – HT And LT Supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of Lighting, Efficacy, LED Lighting And Scope Of Economy In Illumination.

Learning Outcomes: At the end of this unit, students should be able to

- Outline components of electricity billing, transmission, and distribution. (L3)
- Analyse performance characteristics of transformers, capacitors, and electric motors. (L4)
- Examine power factor improvements, and electric motor efficiency. (L3)
- Evaluate lighting systems. (L4)

<u>UNIT – III</u> (9 Hrs)

Thermal Systems: Stoichiometry, Boilers, Furnaces, and Thermic Fluid Heaters – Efficiency Computation and Encon Measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, and Insulators & Refractory's.

Learning Outcomes: At the end of this unit, students should be able to

- Determine efficiency of boilers, furnaces, and other thermal systems. (L3)
- Recommend energy conservation measures in thermal systems. (L2)
- Justify steam systems in energy conservation. (L3)

<u>UNIT – IV</u> (9 Hrs)

Energy Conservation in Major Utilities: Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. Sets.

Learning Outcomes: At the end of this unit, students should be able to

- Explain energy conservation measures in major utilities. (L3)
- Apply performance test criteria for fans, pumps, compressors, havoc systems. (L3)
- Assess energy conservation in cooling towers and D.G. sets. (L3)

<u>UNIT – V</u> (9 Hrs)

Energy Management: Principles of Energy Management, Energy demand estimation, Organizing and Managing Energy Management Programs, Energy pricing.

Learning Outcomes: At the end of this unit, students should be able to

- Describe principles of energy management. (L2)
- Assess energy demand and forecast, organize energy management programs. (L3)
- Design elements of energy pricing. (L5)

TEXTBOOKS:

1. "Energy Manager Training Manual", A Website Administered by Bureau of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government of India, 2004, 4 Volumes Available at ww.energymanagertraining.com

REFERENCE BOOKS:

1. "Industrial Energy Management and Utilisation", Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988.
2. "Design and Management for Energy Conservation", Callaghn, P.W., Pergamon Press, Oxford, 1981
3. "The Efficient Use of Energy", Dryden. I.G.C., Butter worths, London, 1982
4. "Energy Management", Murphy. W. R. and G. Mc Kay, Butter worths, London 1987

Course Code	BASICS OF POWER ELECTRONICS		L	T	P	C
21A020508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operation, characteristics, and usage of power semiconductor devices. **(K2)**
CO2: Understand different types of Rectifier circuits with different operating conditions. **(K2)**
CO3: Understand DC-DC converters operation and analysis of their characteristics. **(K2)**
CO4: Understand the construction and operation of voltage source inverters. **(K2)**
CO5: Apply all the above concepts to solve various numerical problem solving. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	1	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-	1	-

UNIT – I (9 Hrs)

Power Switching Devices: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

Learning Outcomes: At the end of this unit, students should be able to

- Know the V-I characteristics of different semi-conductor devices. (L4)
- Importance of drive circuit for MOSFET, IGBT and GTO. (L3)

UNIT – II (9 Hrs)

Rectifiers: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance.

Learning Outcomes: At the end of this unit, students should be able to

- Derivation of expressions of different configurations of rectifiers. (L3)
- Calculate the Average, R.M.S values of Voltages and Currents. (L4)

<u>UNIT – III</u> (8 Hrs)

DC-DC converters: Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of duty cycle. (L2)
- Analysis of waveforms at steady state of power circuit. (L4)
- Derivation of average output voltage of DC-DC converter. (L3)

<u>UNIT – IV</u> (9 Hrs)

Inverter: Single phase Voltage Source inverters– operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters –Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle operationally.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of pulse width modulation. (L2)
- Analysis of waveforms of single phase and three phase bridge inverters. (L4)

<u>UNIT – V</u> (10 Hrs)

AC voltage controllers & Cyclo converters: voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of TRIAC – TRIAC with R and RL loads– RMS load voltage, current and power actor-waveforms. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down Cyclo converters with Resistive load, Principle of operation, Waveforms, output voltage.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of the phase control and integral cycle control. (L2)
- Know the principal operation of voltage and frequency converter. (L4)
- Analysis waveforms of ac voltage converter and Cyclo converter. (L4)

<u>TEXTBOOKS:</u>

1. "Power Electronics: Circuits, Devices and Applications", M. H. Rashid, Prentice Hall of India, 2nd Edition, 1998

2. "Power Electronics", P. S. Bimbhra, Khanna Publishers, 4th Edition, 2010.
3. "Power Electronics", M. D. Singh & K. B. Khanchandani, Tata Mc Graw Hill Publishing Company, 1998.

REFERENCE BOOKS:

1. "Power Electronics", Ned Mohan, Wiley, 2011
2. "Fundamentals of Power Electronics", Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004
3. "Power Electronics", Vedam Subramanyam, New Age International (P) Limited, 1996.
4. "Power Electronics", V. R. Murthy, Oxford University Press, 1st Edition, 2005.
5. "Power Electronics", P. C. Sen, Tata Mc Graw-Hill Education, 1987
6. "Power Electronic Control of Alternating Current Motors", J. M. D. Murphy.

Course Code	BASICS OF AUTOMOTIVE ENGINEERING		L	T	P	C
21A030507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce various components of an automobile and engine sub systems.
- To impart knowledge on various safety systems of an automobile and emission norms.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the various components of an automobile and Working of fuel supply system. **(K2)**
CO2: Know the working of various lubrication and cooling systems. **(K1)**
CO3: Familiarize with the various systems such as ignition system and transmission system. **(K2)**
CO4: Explain the suspension, braking systems of an automobile and their differences. **(K2)**
CO5: Know about the emissions from engine and safety norms for the operation of an automobile. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction: classification of automobiles, Components of four wheeler automobile- chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive

Fuel supply systems: simple fuel supply system in petrol and diesel engines. Working of simple Carburetor, direct fuel injection system in diesel engine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the parts of automobile engines. (L2)
- Understand the concept of fuel supply systems. (L2)

UNIT – II (7 Hrs)

Lubricating System: Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.

Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the function of Lubricating system. (L3)

<u>UNIT – III</u> (10 Hrs)

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, Electronic ignition system.

Transmission system: Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, Types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the concept of Ignition system and its types. (L2)
- Understand the concept of Transmission system. (L2)

<u>UNIT – IV</u> (10 Hrs)

Suspension System: Objectives of suspension system, front suspension system rigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the working of suspension system and its types. (L2)
- Analyze the different types of braking systems. (L3)

<u>UNIT – V</u> (9 Hrs)

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. Engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand emission concept in automobiles engines. (L2)
- Understand the concept of safety system. (L2)

<u>TEXTBOOKS</u>:

1. "Automobile Engineering Vol-1 & vol-2", Kirpal Singh, Standard Publishers Distributors, 11th Edition.
2. "Automotive Mechanics", William H Crouse & Donald LAnglin, Tata Mc Graw Hill Publications, 10th Edition.
3. "Automobile Engineering", Rajput, Laxmi Publications.

REFERENCE BOOKS:

1. "Automobile Engineering", R.B Gupta, Satya Prakashan Publications, 6th Edition.
2. "The Motor vehicle", Newton steeds & Garrett, Society of Automotive Engineers, 13th Edition.
3. "Automotive Engineering", G.B.S. Narang, Khanna Publishers, 5th Edition.
4. "Automotive Mechanics", Joseph Heitner, IPC Transport Press Ltd, 2nd Edition.
5. "The Automobile", Harbans Singh Reyat, S. Chand & company Pvt. Ltd., 6th Edition.

Course Code	BASICS OF TOTAL QUALITY MANAGEMENT		L	T	P	C
21A030508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concept of quality, cost of quality, international quality standards.
- To learn the principles of Total quality management, techniques for problem solving.
- To learn about various tools of quality management used in various industrial applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts of Quality and Quality Control Techniques. **(K2)**
CO2: Understand TQM concepts and History and able to use quality tools for problem solving. **(K2)**
CO3: Use TQM techniques and to formulate quality circles to find solutions with team work. **(K2)**
CO4: Apply various TQM Methods to solve problems in industry. **(K3)**
CO5: Analyze various quality problems and contribute towards continuous improvement in the system. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	2	-	2	2	2	-	2	-	-	-	2	-	-
CO5	1	-	-	-	-	2	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Inspection & Quality Control

Statistical Quality Control (SQC) – Techniques - variables and attributes Control charts : $\bar{X}$ - R Charts, P-Chart, C-Chart. Acceptance Sampling – Single and Double sampling Plan - OC Curves. BIS and ISO Standards – Importance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Control charts: $\bar{X}$ - R Charts, P-Chart, C-Chart, single and double sampling plans and BIS&ISO standards. (L1)

UNIT – II (8 Hrs)

TQM – concepts, History-Quality management philosophies-Juran, Deming, Crosby, Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – internal and external customers - TQM tools & techniques- 7 QC tools- 7 New QC tools.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various quality management philosophies, Evaluation of TQM, TQM tools and technologies. (L1)

UNIT – III (10 Hrs)

Problem solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis, Quality circles – organization – team approach.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse Problem solving process, system failure analysis, fault tree analysis, pedigree analysis and concept Quality circles. (L4)

UNIT – IV (10 Hrs)

Quality Function Development (QFD) – elements of QFD –benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Know the procedure for quality function development, bench marking, taguchi analysis. (L1)

UNIT – V (8 Hrs)

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management, Six sigma approach – application of six sigma approach to various industrial situations.

Learning Outcomes: At the end of this unit, students should be able to

- Know the value improvement, supplier teaming and the concept of business process re-engineering, supply chain management and six sigma. (L1)

TEXTBOOKS:

1. “Total Quality Management”, D.R.Kiran, BS Publications, 2016
2. “Total Quality Management”, Bester field, Pearson.

REFERENCE BOOKS:

1. “Quality management”, Howard Giltow, TMH
2. “Quality management”, Evans.
3. “Quality management”, Bedi
4. “Total Quality Management”, Joseph & Susan Berg

5. "Total Quality Management-Toward the Emerging Paradigm", Bounds, Yorks, Adams, Ranney, McGraHill, 1994

Course Code	PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS		L	T	P	C
21A040507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyze cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts and operation of cellular systems. **(K2)**

CO2: Apply the concepts of co-channel interference & Cell splitting to solve engineering problems. **(K3)**

CO3: Compare different Handoffs. **(K4)**

CO4: Compare various types of multiple access techniques. **(K4)**

CO5: Evaluate suitability of a cellular system in real time applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	3

UNIT – I (10 Hrs)

Introduction to Cellular Mobile Systems: Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts and operation of cellular systems. (L2)
- Explain the characteristics of mobile radio environment. (L2)

UNIT – II (8 Hrs)

Cellular Radio System Design: General description of the problem, Concept of frequency reuse channels, Co-channel interference reduction, Desired C/I ratio, Cell splitting and sectoring, Microcell zone concept.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of frequency reuse and co-channel interference in cellular systems. (L2)
- Apply the concept of cellular systems to solve engineering problems. (L3)
- Explain the design problems of cellular systems. (L3)

UNIT – III (10 Hrs)

Handoffs and Dropped Calls: Why handoffs and types of handoffs, Initiation of handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Inter system handoff. Introduction to dropped call rate.

Learning Outcomes: At the end of this unit, students should be able to

- Understand why handoff is required. (L2)
- Apply handoff techniques to solve engineering problems. (L3)
- Compare various types of handoffs. (L4)

UNIT – IV (8 Hrs)

Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various types of multiple access techniques. (L2)
- Apply the concept of multiple access to solve engineering problems. (L3)
- Compare various types of multiple access techniques. (L4)

UNIT – V (9 Hrs)

Digital Cellular Systems: Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

Learning Outcomes: At the end of this unit, students should be able to

- Understand operation of various types of digital cellular systems. (L2)
- Compare various types of digital cellular systems. (L2)
- Evaluate suitability of a cellular system in real time applications. (L4)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Mobile Cellular Tele communications", William C.Y.Lee, McGraw – Hill International, 2nd Edition, 1995.
2. "Wireless Communications–Principles and Practice", Theodore S. Rappaport, PHI, 2nd Edition, 2004.

REFERENCE BOOKS:

1. "Principles of Modern Wireless Communications Systems –Theory and Practice", Aditya K. Jagannatham, McGraw – Hill International, 2015.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117102062
2. https://www.electronicshub.org/wireless-communication-introduction-types-applications/

Course Code	EMBEDDED SYSTEMS		L	T	P	C
21A040508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the basics of an embedded system
- To introduce the typical components of an embedded system
- To explain various communication interfaces used in embedded system
- To provide knowledge on the design process of embedded system applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Discuss the basic concepts of an embedded system. **(K3)**

CO2: Explainthe role of system core, memory, sensors, actuators, I/O and other sub system components in an embedded system. **(K3)**

CO3: Explain the different communication interfaces of an embedded system. **(K3)**

CO4: Illustrate about the interrupt service mechanism and device drivers. **(K3)**

CO5: Write aboutvarious steps involved in design and development of embedded firmware. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

Introduction to Embedded Systems: Definition, Embedded systems Vs General computing systems, History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

Learning Outcomes: At the end of this unit, students should be able to

- Classify embedded systems based on generation, complexity and performance. (L2)
- Discuss the characteristics of an embedded system. (L2)
- Explain the design process in embedded system. (L3)

UNIT – II (9 Hrs)

Typical Embedded System: Core of the embedded system, Memory-ROM, RAM, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer, PCB and passive components

Learning Outcomes: At the end of this unit, students should be able to

- Discuss about the core of the embedded system. (L2)
- Summarize different factors to be considered in the selection of memory for an embedded system. (L2)
- Explain the role of sensors, actuators, I/O components and other subsystem components used in embedded system. (L3)

UNIT – III (9 Hrs)

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various types of on-board communication interfaces. (L3)
- Describe the external communication interfaces used in embedded system. (L2)
- Discuss the different types of wireless communication interfaces used in embedded system. (L2)

UNIT – IV (9 Hrs)

Device drivers and Interrupt Service Mechanism: Programmed I/O busy-wait approach without interrupt service mechanism, Interrupt-driven I/O, interrupt service routine concept, interrupt sources, hardware interrupts, software interrupts, interrupt-servicing mechanism, multiple interrupts, interrupt service threads as second-level interrupt handlers, context and the periods for context switching, interrupt latency, interrupt-service deadline, interrupt service mechanism form context-saving angle, Device driver programming.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize pros and cons of interrupt driven data transfer. (L2)
- Illustrate hardware and software interrupts with examples. (L3)
- Know how interrupts can be used to minimize latency. (L3)
- Describe uses of hardware and software assigned priorities in an interrupt service mechanism. (L2)
- Differentiate ISRs & device driver functions. (L2)

UNIT – V (8 Hrs)

Embedded Firmware Design and Development: Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the different approaches for embedded firmware design. (L2)
- Discuss the different embedded firmware development languages. (L2)
- Explain the process of Assembly language to machine language conversion and High-level language to machine language conversion. (L3)
- Write about various steps involved in design and development of embedded firmware. (L3)

TEXTBOOKS:

1. "Introduction to Embedded Systems", Shibu. K.V., McGraw Hill Education, 2nd Edition, 2017.
2. "Embedded Systems: Architecture, Programming and Design", Raj Kamal, McGraw Hill Education, 3rd Edition, 2017

REFERENCE BOOKS:

1. "Computers as Components", Wayne Wolf, Morgan Kaufmann, Elsevier, 2nd Edition
2. "Embedded Systems- An integrated approach", Lyla B Das, Pearson education, 2012
3. "Embedded Microcomputer Systems Real Time Interfacing", Jonathan W.Valvano, Cengage Learning, 3rd Edition, 2012.

HONOURS

Course Code	ADVANCED COMPUTER NETWORKS (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN01			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand computer network architectures, protocols, and interfaces.
- The OSI reference model and the Internet architecture network applications.
- Expose students to the concepts of traditional as well as modern day computer networks - wireless and mobile, multimedia-based.
- To understand the key concepts and practices employed in modern computer networking

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Summarize the network performance or network types. **(K2)**
CO2: Illustrate switching, transferring and address classifications of networks. **(K3)**
CO3: Calculate IP addresses and apply link layer protocols. **(K3)**
CO4: Analyze the internet working functionalities. **(K4)**
CO5: Classify application layer functionalities or multimedia applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (12 Hrs)

Network Architecture, Performance: Bandwidth and Latency, High Speed Networks, Network-Centric View, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks, Overlay Networks: Routing Overlays, Peer-to-Peer Networks and Content Distribution Networks, Client-Server Networks, Delay Tolerant Networks

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network performance. (L1)
- Differentiate the different types of networks. (L2)
- Identify the reliable and unreliable networks. (L1)

UNIT – II (12 Hrs)

Switching: Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Message-Switched Networks, Asynchronous Transfer Mode: Evolution, Benefits, Concepts,

Exploring Broadband Integrated Services Digital Network, Layer and Adaptation Layer, IPv4: Address Space, Notations, Classful, Classless, Network Address Translation, Datagram

Learning Outcomes: At the end of this unit, students should be able to

- Describe the switching process over networks. (L1)
- Explain data transmission process. (L1)
- Illustrate IPV4 addresses and classifications. (L3)

UNIT – III (10 Hrs)

Fragmentation and Checksum IPv6 Addresses: Structure, Address Space, Packet Format and Extension Headers, ICMP, IGMP, ARP, RARP, Congestion Control and Resource Allocation: Problem, Issues, Queuing, TCP Congestion Control, Congestion-Avoidance Mechanisms and Quality of Service

Learning Outcomes: At the end of this unit, students should be able to

- Perform fragmentations and error detection or correction approaches. (L3)
- Identify different network layer protocols. (L2)
- Estimate congestion occurrence and avoiding procedures. (L3)

UNIT – IV (8 Hrs)

Internetworking: Intra-Domain and Inter-Domain Routings, Unicast Routing Protocols: RIP, OSPF and BGP, Multicast Routing Protocols: DVMRP, PIM-DM, PIM-SM, CBT, MSDP and MOSPF, Spanning Tree Algorithm, Optical Networking: SONET/SDH Standards, Traffic Engineering: Requirement, Traffic Sizing, Characteristics, Protocols, Time and Delay Considerations, Connectivity, Availability, Reliability and Maintainability and Throughput.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze internetworking and routing process. (L4)
- Classify internetworking protocols. (L4)
- Illustrate optical networking and engineering functionalities. (L3)

UNIT – V (8 Hrs)

Multimedia Over Internet: Transmission, IP Multicasting and VoIP, Domain Name System: Name Space, Domain Name Space, Distribution, Domains, Resolutions and Dynamic Domain Name System, SNMP, Security: IPSec, SSL/TLS, PGP and Firewalls, Datacenter Design and Interconnection Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the multimedia transmission over internet. (L4)
- Illustrate domain name system. (L3)
- Apply security policies over interconnected networks. (L3)

TEXTBOOKS:

1. “Computer Networks: A System Approach”, Larry L. Peterson and Bruce S. Davie, 5th Edition, Morgan Kaufmann, Elsevier, 2012.
2. “Data Communications and Networking”, Behrouz A. Forouzan, McGraw Hill, 5th Edition, 2017.
3. “Introduction to Computer Networks and Cyber Security”, Chwan-Hwa (John) Wu, J. David Irwin, CRC press, Taylor & Francis Group, 2014
4. “Computer Networks”, Andrew S. Tanenbaum, David J. Wetherall, Pearson, 5th Edition, 2014.

REFERENCE BOOKS:

1. “Advanced Computer Networking: Concepts and Applications”, Satish Jain

Course Code	OBJECT ORIENTED SOFTWARE ENGINEERING (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN02			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To learn and understand various O-O concepts along with their applicability contexts.
- To identify domain objects, their properties, and relationships among them.
- To identify and model/represent domain constraints on the objects and (or) on their relationships
- To learn various modelling techniques to model different perspectives of object-oriented software design (UML)

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the given project in various phases of a software lifecycle. **(K2)**
CO2: Analyze software requirements with use cases. **(K4)**
CO3: Examine the various design and development solutions with proper analysis. **(K3)**
CO4: Design and implement the Software projects. **(K3)**
CO5: Compare various testing methods. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Introduction to Software Engineering - Software Development process models – Agile Development - Project & Process - Project management - Process& Project metrics - Object Oriented concepts, Principles & Methodologies.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of software engineering. (L2)
- Illustrate the various development activities. (L2)

UNIT – II (10 Hrs)

Software Requirements Specification, Software prototyping - Software project planning - Scope - Resources - Software Estimation - Empirical Estimation Models – Planning - Risk Management - Software Project Scheduling - Object Oriented Estimation & Scheduling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand about software requirements specifications. (L2)

- Explain various software resources. (L5)

UNIT – III (11 Hrs)

Analysis Modelling - Data Modelling - Functional Modelling& Information Flow – Behavioural Modelling Structured Analysis - Object Oriented Analysis - Domain Analysis-Object oriented Analysis process - Object Relationship Model - Object Behaviour Model, Design modelling with UML

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various analysis concepts. (L5)
- Design modelling with UML. (L6)

UNIT – IV (10 Hrs)

Design Concepts & Principles - Design Process - Design Concepts - Modular Design - Design Effective Modularity - Introduction to Software Architecture - Data Design - Transform Mapping - Transaction Mapping - Object Oriented Design - System design process- Object design process - Design Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- List the basic design patterns. (L1)
- Describe the object oriented design and system design process. (L2)

UNIT – V (9 Hrs)

Top - Down, Bottom-Up, object oriented product Implementation & Integration. Software Testing methods White Box, Basis Path-Control Structure - Black Box - Unit Testing - Integration testing - Validation & System testing - Testing Tools – Software Maintenance & Reengineering

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate various software testing methods. (L2)
- Illustrate software maintenance and reengineering. (L3)

TEXTBOOKS:

1. "Software Engineering Concepts", Fairley R, 2nd edition, Tata McGraw Hill, New Delhi, 2003.
2. "An Integrated Approach to Software Engineering", Jalote P, 3rd edition, Narosa Publishers, New Delhi, 2013.

REFERENCE BOOKS:

1. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh, Ivar Jacobson, Addison Wesley, 1999.

2. "Object Oriented Systems Development", Ali Bahrami, 1st Edition, The McGraw-Hill Company, 1999

Course Code	SERVICE ORIENTED ARCHITECTURE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN03			3	1	0	4
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To understand SOA and evolution of SOA.
- To understand web services and primitive, contemporary SOA.
- To understand various service layers.
- To understand service-oriented analysis and design based on guidelines.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the characteristics and issues of SOA. **(K2)**
CO2: Classify and implement various message patterns of SOA. **(K3)**
CO3: Analyze various principles and services of SOA. **(K4)**
CO4: Implement a service using WSDL. **(K3)**
CO5: Design a SOA service for various Business Models. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Introducing SOA: Fundamental SOA, Common Characteristics of Contemporary SOA, Common Tangible Benefits of SOA, Common Pitfalls of Adopting SOA. The Evolution of SOA: An SOA Timeline, The Continuing Evolution of SOA, The Roots of SOA.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the fundamentals of SOA. (L1)
- Understand the advantages and disadvantages of SOA. (L2)

UNIT – II (11 Hrs)

Web Services and Primitive SOA: The Web Services Frame Work, Services, Service Descriptions, Messaging. Web Services and Contemporary SOA (Part I-Activity management and Composition): Message Exchange Patterns, Service Activity, Coordination, Atomic Transactions, Orchestration, and Choreography. Web Services and Contemporary SOA (Part-II-Advanced Messaging, Metadata and Security): Addressing, Reliable Messaging, Correlation, Policies, Metadata exchange, Security.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various service primitive. (L2)
- Compare primitive and contemporary SOA. (L4)

<u>UNIT – III</u> (11 Hrs)

Principles of Service-Orientation: Service–Orientation and the Enterprise, Anatomy of SOA, Common Principles of Service–Orientation, Interrelation between Principles of Service-Orientation, Service Orientation and Object Orientation, Native Web Services Support for Principles of Service-Orientation. Service Layers: Service-Orientation and Contemporary SOA, Service Layer abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer, Agnostic Services, Service Layer Configuration Scenarios

Learning Outcomes: At the end of this unit, students should be able to

- Examine the Native Web services support for principles of SOA. (L3)
- Analyze various services in various layers of SOA. (L4)

<u>UNIT – IV</u> (12 Hrs)

SOA Delivery Strategies: SOA Delivery Lifecycle Phases, The Top-Down Strategy, The Bottom-up Strategy, The Agile Strategy. Service Oriented Analysis (Part I-Introduction): Introduction to Service Oriented Analysis, Benefits of a Business Centric SOA, Deriving Business Services. Service Oriented Analysis (Part-II-Service Modelling): Service Modelling, Service Modelling Guidelines, Classifying Service Model Logic, Contrasting Service Modelling Approaches. Service Oriented Design (Part I-Introduction): Introduction to Service-Oriented Design, WSDL Related XML Schema Language Basics, WSDL Language Basics, Service Interface Design Tools. Service Oriented Design (Part II-SOA Composition Guidelines): SOA Composing Steps, Considerations for Choosing Service Layers, Considerations for Positioning Core SOA Standards, Considerations for Choosing SOA Extensions.

Learning Outcomes: At the end of this unit, students should be able to

- Deploying a service using WSDL. (L3)

<u>UNIT – V</u> (10 Hrs)

Service Oriented Design (Part III- Service Design): Service Design Overview, Entity- Centric Business Service Design, Application Service Design, Task-Centric Business Service Design, Service Design Guidelines. Service Oriented Design (Part IV-Business Process Design): WS-BPEL Language Basics, WS- Coordination Overview, Service Oriented Business Process Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Web services Designs. (L2)
- Implement a SOA following the design guidelines. (L3)

TEXTBOOKS:

1. "Service-Oriented Architecture-Concepts, Technology and Design", Thomas Erl, Pearson Education, 2006.
2. "Understanding SOA with Web Services", Eric Newcomer, Greg Lomow, Pearson Education, 2005

REFERENCE BOOKS:

1. "Service Oriented Architecture Concepts Technology & Design", Thomas Erl, Pearson Education Limited; 2015, ISBN-13: 9788131714904.
2. "Service Oriented Architecture An Integration Blueprint", Guido Schmutz, Peter Welkenbach, Daniel Liebhart, Shroff Publishers & Distributors; 2010, ISBN-13: 9789350231081

Course Code	ADVANCED OPERATING SYSTEMS (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A05HN04			**3**	**1**	**0**	**4**
Pre-requisite	NIL	Semester	-			

COURSE OBJECTIVES:

- To be able to read and understand sample open source programs and header files.
- System calls which explore networking and security applications.
- To acquire the knowledge in the implementation of interprocess communication.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Realize the internals of Unix file system and analyze the functionalities of operating system. **(K3)**

CO2: Examine processes mechanism in operating system. Compare & contrast various system calls. **(K4)**

CO3: Understand the functionality of VFS. Analyze various file system types. **(K4)**

CO4: Realize the internals of windows operating system. Analyze the functionalities of windows operating systems. **(K4)**

CO5: Build mobile applications using Android. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	3	1	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	1	-	-	-	-	-	-	1	3	2

UNIT – I (10 Hrs)

Basic Operating System Concepts - Overview of Unix File System - Files - Links - Types – Inodes -Access Rights - System Calls - Overview of Unix Kernels -Model - Implementation - Reentrant Kernels - Address Space - Synchronization - Interprocess Communication - Process Management - Memory Management - Device Drivers.

Learning Outcomes: At the end of this unit, students should be able to

- Define functionalities of Unix file system. (L1)
- Categorize different kinds of system calls. (L4)

UNIT – II (10 Hrs)

Processes, Lightweight Processes, and Threads - Process Descriptor - State - Identifying a Process - Relationships among processes - Organization - Resource Limits - Creating Processes - System Calls - Kernel Threads - Destroying Processes -Termination - Removal.

Learning Outcomes: At the end of this unit, students should be able to

- Identify various states in process life cycle. (L2)
- Differentiate processes, system calls, kernel threads. (L4)

UNIT – III (10 Hrs)

The Virtual File System (VFS) - Role - File Model -System Calls - Data Structures - Super Block, Inode, File, dentry Objects - dentry Cache - Files Associated with a Process - Filesystem Types - Special Files systems – Filesystem Type Registration – Filesystem Handling - Namespaces - Mounting – Unmounting - Implementation of VFS System Calls

Learning Outcomes: At the end of this unit, students should be able to

- Implement VFS system calls. (L3)
- Distinguish file system types and special file systems. (L3)
- Define functionalities of VFS. (L1)

UNIT – IV (10 Hrs)

Windows Operating system - versions, Concepts and tools, Windows internals, System Architecture, Requirements and design goals, Operating system model, Architecture overview. Key system components. System mechanisms - Trap dispatching, object manager, Synchronization, System worker threads, Windows global flags, Local procedural calls, Kernel event tracing.

Learning Outcomes: At the end of this unit, students should be able to

- Define functionalities of windows operating system. (L1)
- Differentiate various system mechanisms. (L4)

UNIT – V (10 Hrs)

What is android, basic building blocks – activities, services, broadcast receivers & content, ui components views & notifications, components for communication -intents & intent filters, android api levels launching emulator editing emulator settings emulator shortcuts log cat usage, Applications of Android

Learning Outcomes: At the end of this unit, students should be able to

- Develop various applications using Android. (L6)
- Identify building blocks of Android. (L2)

TEXTBOOKS:

1. "Understanding the Linux Kernel", Daniel P. Bovet and Marco Cesati, 3rd Edition, O'Reilly Publications, 2005.
2. “Structure and Interpretation of Computer Programs”, Harold Abelson, Gerald Jay Sussman and Julie Sussman, 2nd Edition, Universities Press, 2013.

REFERENCE BOOKS:

1. "Microsoft Windows Internals", Mark E. Russinovich and David A. Solomon, 4th Edition, Microsoft Press, 2004