Jawaharlal Nehru TechnologicalUniversity Anantapur

(Established by Govt. of A.P., Act. No. 30 of 2008)

Ananthapuramu–515 002 (A.P) India

M.Tech. in Machine Design

Course Structures and Syllabi under R17 Regulations

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Course Structure and syllabus for M.Tech-ME-Machine Design
for affiliated Engineering Colleges 2017-18

I YEAR I SEMESTER

S. No	Course code	Subject	L	T	P	C
1.	17DBS101	Computational Methods	4	-	-	4
2.	17D04101	Advance Finite element methods	4	-	-	4
3.	17D15101	Advanced Mechanisms	4	-	-	4
4.	17D15102	Advanced Mechanics of Solids	4	-	-	4
5.	 17D15103 17D15104 17D15105	Elective –I a. Computer Applications in Design b. Materials Technology c. Quality Concepts in Design	4	-	-	4
6.	 17D15106 17D15107 17D04105	Elective – II a Tribology in Design b Gear Engineering c Design of Hydraulic and Pneumatic Systems	4	-	-	4
7.	17D15108	Simulation Lab		-	3	2
		Total	24	-	3	26

I YEAR II SEMESTER

S. No	Course code	Subject	L	T	P	C
1.	17D04201	Advanced Optimization Techniques	4	-	-	4
2.	17D15201	Fracture fatigue and creep deformation	4	-	-	4
3.	17D04202	Industrial Robotics and Expert system	4	-	-	4
4.	17D15202	Mechanical Vibrations	4	-	-	4
5.	 17D15203 17D15204 17D15205	Elective – III a. Experimental Stress Analysis b. Theory of Plasticity c. Applied Engineering Acoustics	4	-	-	4
6.	 17D04109 17D15206 17D15207	Elective – IV a. Design for Manufacturing b. Pressure Vessel Design c. Mechanics of Composite Materials	4	-	-	4
7.	17D15208	Machine Dynamics Lab	-	-	3	2
		Total	24	-	3	26

III SEMESTER

S. No	Subject Code	Subject	L	T	P	C
1.	17D20301 17D20302 17D20303	Elective V a) Research Methadology b) Human Values and Professional Ethics c) Intellectual Property Rights	4	-	-	4
2.	17D15301	Elective VI (MOOCS)	-	-	-	-
3.	17D15302	Comprehensive Viva – Voice	-	-	-	2
4.	17D15303	Seminar	-	-	-	2
5.	17D15304	Teaching Assignment	-	-	-	2
6.	17D15305	Project work phase – I	-	-	-	4

IV SEMESTER

S.No	Subject Code	Subject	L	T	P	C
1.	17D15401	Project work Phase – II	-	-	-	12

Project Viva Voce Grades:

A: Satisfactory
B: Not Satisfactory

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

L	T	P	C
4	0	0	4

(17DBS101) COMPUTATIONAL METHODS

Unit – I

Introduction to numerical methods applied to engineering problems: Examples, solving sets of equations – Matrix notation – Determinants and inversion – Iterative methods – Relaxation methods – System of non-linear equations – computer programs

Unit – II

Numerical integration: Newton-Cotes integration formulas – Simpson's rules, Gaussian quadrature. Adaptive integration

Unit – III

Optimization:

One dimensional unconstrained optimization, multidimensional unconstrained optimization – direct methods and gradient search methods, constrained optimization

Unit – IV

Boundry value problems and charecteristic value problems: Shooting method – Solution through a set of equations – Derivative boundary conditions – Rayleigh – Ritz method – Characteristic value problems.

Unit – V

Numerical solutions of partial differential equations: Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangular grids – Matrix patterns, sparseness – ADI method – Finite element method.

Unit – VI

Parabolic partial differential equations: Explicit method – Crank-Nickelson method – Derivative boundary condition – Stability and convergence criteria – Finite element for heat flow – computer programs.

Unit – VII

Hyperbolic partial differential equations: Solving wave equation by finite differences-stability of numerical method –method of characteristics-wave equation in two space dimensions-computer programs.

Unit – VIII

Curve fitting and approximation of functions: Least square approximation fitting of non-linear curves by least squares –regression analysis- multiple linear regression, non linear regression - computer programs.

TEXT BOOKS:

1. Steven C.Chapra, Raymond P.Canale "Numerical Methods for Engineers" Tata Mc-Graw hill
2. Curtis F.Gerald, partick.O.Wheatly,"Applied numerical analysis"Addison-wesley,1989
3. Douglas J..Faires,Riched Burden"Numerical methods"Brooks/cole publishing company,1998.Second edition.

REFERENCES:

1. 1.Ward cheney &David Kincaid "Numerical mathematics and computing"Brooks/cole publishing company1999,fourth edition.
2. 2.Riley K.F.M.P.Hobson&Bence S.J,"mathematical methods for physics and
3. engineering"Cambridge university press,1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

L	T	P	C
4	0	0	4

(17D04101) ADVANCED FINITE ELEMENT METHODS

Course objective: You learn modern analysis techniques used widely in engineering practice and the sciences, and you use these techniques in a general finite element program.

You learn how to establish computational models of problems of solids and fluids, solve them on your laptop, and assess the accuracy of the results.

You capitalize on your knowledge of mechanics, reinforce your knowledge, and solve problems that can only be tackled numerically on the computer. Great knowledge in your tool box whatever your goals.

UNIT – I

Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements., Variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions.

UNIT – II

One-dimensional finite element methods: Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection problems. Examples: - one dimensional fin,

UNIT – III

Trusses: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, temperature effects.

Beams and Frames: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

UNIT – IV

Two dimensional problems: CST, LST, four noded and eight nodded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin.

Isoparametric formulation: Concepts, sub parametric, super parametric elements, numerical integration.

UNIT – V

Finite elements in Structural Dynamics: Dynamic equations, eigen value problems, and their solution methods, simple problems.

Convergence: Requirements for convergence, h-refinement and p-refinement, complete and incomplete interpolation functions, pascal's triangle.

Course out comes: Students will learn the mathematical formulation of the finite element method and how to apply it to basic (linear) ordinary and partial differential equations. Students will also learn how to implement the finite element method efficiently in order to solve a particular equation.

TEXT BOOK:

Introduction to Finite element methods by Chandraputla & Ashok D.Belagondu by Pearson 2012

An introduction to Finite element methods by VN Reddy published by Mcgraw Hill 2006.

REFERENCES:

1. Finite element method in Heat transfer and fluid dynamics, J.N.Reddy, CRC press,1994
2. Finite Element Method, Zienckiwicz O.C. & R. L. Taylor,McGraw-Hill,1983.
3. Finite Element of Nonlinear continua, . J. N. Oden, McGraw-Hill, New York, 1971.
4. Finite element procedures, K. J. Bathe, Prentice-Hall, 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

L	T	P	C
4	0	0	4

(17D15101) ADVANCED MECHANISMS

Course Objectives:

To develop student understanding of the theoretical background for basic and advanced kinematics and synthesis of mechanisms to achieve desired motion.

To introduce students to basic and advanced computer-based tools for analysis and synthesis of mechanisms.

To provide an opportunity for students to use theory and application tools through a major mechanism design project.

To improve student ability to communicate understanding of the subject through professional technical reports and oral presentations.

Unit - I

Introduction: Elements of Mechanisms; Mobility Criterion for Planar mechanisms and manipulators; Mobility Criterion for spatial mechanisms and manipulators. Spherical mechanisms-spherical trigonometry.

Kinematics of plane motion- I: The Inflection circle ; Euler – Savary Equation; Analytical and graphical determination of d_i ; Bobillier's Construction ;Collineastion axis ; Hartmann's Construction ;Inflection circle for the relative motion of two moving planes; Application of the Inflection circle to kinematic analysis.

Unit – II

Kinematics of plane motion - II: Polode curvature; Hall's Equation; Polode curvature in the four bar mechanism; coupler motion; relative motion of the output and input links; etermination of the output angular acceleration and its Rate of change; Freudenstein's collineation –axis theorem; Carter –Hall circle; The circling – point curve for the Coupler of of a four bar mechanism.

Unit - III

Introduction to Synthesis-Graphical Methods: The Four bar linkage ;Guiding a body through Two distinct positions; Guiding a body through Three distinct positions; The Rotocenter triangle ; Guiding a body through Four distinct positions; Burmester's curve.

Function generation- General discussion; Function generation: Relative –rotocenter method, Overlay's method, Function generation- Velocity – pole method; Path generation: Hrones's and Nelson's motion Atlas, Roberts's theorem.

Unit – IV

Introduction to Synthesis - Analytical Methods: Function Generation: Freudenstien's equation, Precision point approximation, Precision – derivative approximation; Path Generation: Synthesis of Four-bar Mechanisms for specified instantaneous condition; Method of components; Synthesis of Four-bar Mechanisms for prescribed extreme values of the angular velocity of driven link; Method of components.

Unit - V

Manipulator kinematics: D-H notation, D-H convention of assignment of co-ordinate frames and link parameters table;D-H transformation matrix ; Direct and Inverse kinematic analysis of Serial manipulators: Articulated ,spherical & industrial robot manipulators- PUMA, SCARA,STANFORD ARM, MICROBOT.

Differential kinematics Formulation of Jacobian for planar serial manipulators and spherical manipulator; Singularity analysis.

Course Outcomes: In this course, we will study advanced topics in kinematics with a focus of mechanism synthesis techniques. The course will primarily focus on planar mechanism, but will also treat spherical and spatial mechanisms. Course content will come from a variety of sources including class notes, texts, and journal articles. Course topics will be applied through a semester long design project. Topics of study include: review of kinematics fundamentals, classification of mechanisms, type synthesis, graphical synthesis techniques, and analytical synthesis techniques including dyad form, ground pivot specification, M&K circles, Burmester curves, Chebychev spacing, velocity synthesis, four and five prescribed positions, and multi-loop synthesis. Spherical mechanisms, spatial mechanisms, spatial transformations, and spatial dyad synthesis will also be discussed. This course will involve large amounts of team interaction through active learning activities in class and a major design project, which will implement the key topics presented in class through practical applications.

Text Books:

1. Jeremy Hirschhorn, Kinematics and Dynamics of plane mechanisms, McGraw-Hill,1962.
2. L.Sciavicco and B.Siciliano, Modelling and control of Robot manipulators, Second edition, Springer -Verlag,London,2000.
3. Amitabh Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines. E.W.P.Publishers.

REFERENCES:

1. Allen S.Hall Jr., Kinematics and Linkage Design, PHI,1964.
2. J.E Shigley and J.J . Uicker Jr., Theory of Machines and Mechanisms , McGraw-Hill, 1995.
3. Mohsen Shahinpoor, A Robot Engineering Text book,Harper & Row Publishers, New York,1987.
4. Joseph Duffy, Analysis of mechanisms and Robot manipulators, Edward Arnold,1980

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

L	T	P	C
4	0	0	4

(17D15102) ADVANCED MECHANICS OF SOLIDS

Course Objectives: After completing this course, the students would be able to 1. describe the concept of "stress at a point" (state of stress and strain in 3D) 2. analyze the transformation of stress and strain in 3D including the utilization of yield criteria 3. apply the knowledge to design the mechanical structures in the view point of both strength and deformation including the design by means of numerical simulation.

Unit I

Shear center: Bending axis and shear center-shear center for axi-symmetric and unsymmetrical sections

Unsymmetrical bending: Bending stresses in Beams subjected to Nonsymmetrical bending; Deflection of straight beams due to nonsymmetrical bending.

Unit II

Curved beam theory: Winkler Bach formula for circumferential stress – Limitations – Correction factors –Radial stress in curved beams – closed ring subjected to concentrated and uniform loads-stresses in chain links.

Torsion : Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section ;Hollow thin wall torsion members ,Multiply connected Cross Section.

Unit III

Contact stresses: Introduction; problem of determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact, Normal and Tangent to contact area.

Unit IV

Two Dimensional Elasticity Problems: Plane stress & Plain strain-Problems in Rectangular Co-ordinates, bending of cantilever loaded at the end, bending of a beam by uniform load.

general equations in polar coordinates, stress distribution symmetrical about an axis, pure bending of curved bars, displacements for symmetrical stress distributions, rotating discs.

Unit V

Introduction to Three Dimensional Problems: Uniform stress stretching of a prismatical bar by its own weight, twist of circular shafts of constant cross section, pure bending of plates.

Course outcomes: Fundamental Concept, Introduction to Cartesian Tensors, Two and Three Dimensional Theories of Stress and Strain (Method of Continuum Mechanics, Theory of Elasticity), Generalized Hooke's Law (Linear Stress-Strain-Temperature), Energy Principal in Solid Continuum, Application of Energy Methods, Inelastic Material Behavior, Theories of Failure, Application of Elasticity

TEXTBOOKS:

1.Advanced Mechanics of materials by Boresi & Sidebottom-Wiely International.

2. Theory of elasticity by Timoschenko S.P. and Goodier J.N. McGraw-Hill Publishers 3/e

REFERENCES:

1. Advanced strength of materials by Den Hortog J.P.
2. Theory of plates – Timoshenko.
3. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia
4. Strength of materials by Sadhu singh

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

L	T	P	C
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(17D15103) COMPUTER APPLICATIONS IN DESIGN
(Elective-I)

Course objective:
To impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc.

UNIT I
INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS
Output primitives (points, lines, curves etc.,), 2-D & 3-D transformation (Translation, scaling, rotators) windowing - view ports - clipping transformation.

UNIT II CURVES AND SURFACES MODELLING
Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations. Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface , surface of revolution and tabulated cylinder – synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline surface- surface manipulations.

UNIT III NURBS AND SOLID MODELING
NURBS- Basics- curves , lines, arcs, circle and bi linear surface. Regularized Boolean set operations - primitive instancing - sweep representations - boundary representations - constructive solid Geometry - comparison of representations - user interface for solid modeling.

UNIT IV VISUAL REALISM
Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages.

UNIT V ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE
Assembly modeling - interferences of positions and orientation - tolerances analysis - mass property calculations - mechanism simulation. Graphics and computing standards– Open GL Data Exchange standards – IGES, STEP etc– Communication standards..

Course outcome:

With laboratory classes in conjunction, It helps the students to get familiarized with the computer graphics application in design. This understanding reinforces the knowledge being learned and shortens the overall learning curves which are necessary to solve CAE problems that arise in engineering.

REFERENCES

1. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", Mc Graw Hill Book Co. Singapore, 1989.
2. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc., 1992.
3. Ibrahim Zeid Mastering CAD/CAM – McGraw Hill, International Edition, 2007.
4. Foley, Wan Dam, Feiner and Hughes – Computer graphics principles & practices, Pearson Education – 2003.
5. David F. Rogers, James Alan Adams "Mathematical elements for computer graphics" second edition, Tata McGraw-Hill edition.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

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(17D15104) MATERIALS TECHNOLOGY
(Elective-I)

Course objective: The student should be able to understand
and classify the sub branches and domains of Materials & Metallurgical Engineering stream.
The student should be able to analyze the possible opportunities in the domains of Materials & Metallurgical Engineering.
The student should be able to understand all basic principles involved in the theory of Elasticity and Plasticity

Unit – I
Elasticity in metals and polymers: Mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening.

Unit – II
Poly phase mixture, precipitation: particle, fiber and dispersion strengthening , effect of temperature, strain and strain rate on plastic behavior, super plasticity, deformation of non crystalline material.
Motivation of selection, cost basis and service requirements, selection for mechanical properties, strength, toughness, fatigue and creep.
Unit – III-
Modern metallic Materials: Dual phase steels, micro alloyed, high strength low alloy (HSLA) Steel, transformation induced plasticity (TRIP) Steel, maraging steel, intermetalics, Ni and Ti aluminides
Unit – IV-
Smart materials: shape memory alloys, metallic glass, quasi crystal and nano crystalline materials.
Non metallic materials: Polymeric materials and their molecular structures, production techniques for fibers, foams, adhesives and coatings, structure, properties and applications of engineering polymers.
Unit – V-
Advanced structural ceramics : WC, TiC, TaC, Al2O3, SiC, Si3 N4, CBN and diamond-properties, processing and applications.
Advance structural composites; Introduction, reinforcement, types of composite materials, -properties, processing and application, and mechanics of composite materials.

Course outcomes: The student will be able to understand and create the areas and domains in Materials & Metallurgical Engineering on the basis of his/her interestand opportunity available in present industrial scenario.
The student will be able to understand the basic principles of selection of materials and challenges to entrepreneurs in metallurgy

TEXT BOOKS:

1. Mechanical behavior of materials/Thomas H.Courtney/2nd Edition, McGraw-Hill, 2000
2. Mechanical Metallurgy/George E.Dieter/McGraw Hill, 1998

REFERENCES:

1. Selection and use of Engineering Materials 3e/Charles J.A/Butterworth Heiremann.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)	**L**	**T**	**P**	**C**
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(17D15105) QUALITY CONCEPTS IN DESIGN
Elective-I

Course objectives:
To impart knowledge on various concepts in engineering design and principles of implementing quality in a product or service through tools such as quality houses, control charts, statistical process control method, failure mode effect analysis and various strategies of designing experiments, methods to uphold the status of six sigma and improve the reliability of a product.
To gather knowledge on fundamentals of design and its methods, robust design, embodiment principles, various methods in design of experiments, reliability, statistical tools and six sigma techniques.

UNIT I
DESIGN FUNDAMENTALS, METHODS AND MATERIAL SELECTION
Morphology of Design – The Design Process – Computer Aided Engineering – Concurrent Engineering – Competition Bench Marking – Creativity – Theory of Problem solving (TRIZ) – Value Analysis - Design for Manufacture, Design for Assembly – Design for casting, Forging, Metal Forming, Machining and Welding
UNIT II
DESIGN FOR QUALITY
Quality Function Deployment -House of Quality-Objectives and functions-Targets-Stakeholders-Measures and Matrices-Design of Experiments –design process-Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design –testing noise factors- Running the experiments – Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.
UNIT III
FAILURE MODE EFFECT ANALYSIS AND DESIGN FOR SIX SIGMA
Basic methods: Refining geometry and layout, general process of product embodiment - Embodiment checklist- Advanced methods: systems modeling, mechanical embodiment principles-FMEA method- linking fault states to systems modeling - Basis of SIX SIGMA –Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services **UNIT IV**
DESIGN OF EXPERIMENTS

mportance of Experiments, Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments - Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments - Two and three factor full Factorial experiments, 2K factorial Experiments, Confounding and Blocking designs, Fractional factorial design, Taguchi's approach - Steps in experimentation, Design using Orthogonal Arrays, Data Analysis, Robust Design- Control and Noise factors, S/N ratios

UNIT V

STATISTICAL CONSIDERATION AND RELIABILITY

Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams –Multivariable charts –Matrix plots and 3-D plots.- Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distribution

Course outcomes:

It helps the design cum quality engineer to get familiarized with various concepts in design, quality and reliability principles in the design of an engineering product or a service.

REFERENCES

1. Dieter, George E., "Engineering Design - A Materials and Processing Approach", McGraw Hill, International Editions, Singapore, 2000.
2. Product Design Techniques in Reverse Engineering and New Product Development, KEVIN OTTO & KRISTIN WOOD, Pearson Education (LPE), 2001.
3. Product Design And Development, KARL T. ULRICH, STEVEN D. EPPINGER, TATA McGRAW-HILL- 3rd Edition, 2003.
4. The Management and control of Quality-6th edition-James R. Evens, William M Lindsay Pub:son south-western(www.swlearning.com)
5. Fundamentals of Quality control and improvement 2nd edition, AMITAVA MITRA, Pearson Education Asia, 2002.
6. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, 2003.
7. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

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(17D15106) TRIBOLOGY IN DESIGN
Elective-II

Course objective: Majority of mechanical equipment / mechanisms involve relative motion of links or parts. The course intends to impart concepts of friction, wear and lubrication and application of tribology in design of mechanical components is also introduce

Unit – I

Introduction: Nature of surfaces and contact-Surface topography-friction and wear mechanisms and effect of lubricants- methods of fluid film formation.

Selection of rolling element bearings: Nominal life, static and dynamic capacity-Equivalent load, probabilities of survival- cubic mean load- bearing mounting details, pre loading of bearings, conditioning monitoring using shock pulse method.

Unit – II

Hydrodynamic bearings: Fundamentals of fluid formation – Reynold's equation; Hydrodynamic journal bearings – Sommerfield number- performance parameters – optimum bearing with maximum load capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings; Raimondi and Boyd solution for hydrodynamic thrust bearings- fixed tilting pads, single and multiple pad bearings-optimum condition with largest minimum film thickness.

Unit – III

Hydrostatic Bearings: Thrust bearings – pad coefficients- restriction- optimum film thickness- journal bearings – design procedure –Aerostatic bearings; Thrust bearings and Journal bearings – design procedure.

Dry rubbing Bearings: porous metal bearings and oscillatory journal bearings – qualitative approach only.

Unit – IV

Lubrication: Choice of lubricants, types of oil, Grease and solid lubricants- additives- lubrication systems and their selection – selection of pump, filters, piping design- oil changing and oil conservation.

Unit – V

Seals: different type-mechanical seals, lip seals, packed glands, soft piston seals, Mechanical piston rod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves – selection of mechanical seals.

Failure of Tribological components: Failure analysis of plain bearings, rolling bearings, gears and seals, wear analysis using soap and Ferrography.

Course Outcome: After learning the course the students should be able to: 1. Understand the fundamentals of tribology and associated parameters. 2. Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.

Text Books:

1. Rowe WW& O' Dionoghue,"Hydrostatic and Hybrid bearing design " Butterworths & Co.Publishers Ltd,1983.
2. Collacott R.A," Mechanical Fault diagnosis and condition monitoring", Chapman and Hall, London 1977.
3. Bernard J.Hamrock, " Fundamentals of fluid film lubricant", Mc Graw-Hill Co.,1994.

References:

1. 1.Neale MJ, (Editor) " Tribology hand Book"Neumann Butterworths, 1975.
2. 2.Connor and Boyd JJO (Editors) " Standard hand book of lubrication engineers " ASLE,Mc Graw Hill Book & Co.,1968
3. Shigley J, E Charles," Mechanical Engineering Design", McGraw Hill Co., 1989

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

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(17D15107) GEAR ENGINEERING
Elective-II
(PSG Design data Book to be used and allowed in Examinations)

Course objective:This course introduces all varieties of Circuit Breakers and Relays for protection of Generators, Transformers and feeder bus bars from over voltages and other hazards. It emphasis on Neutralgrounding for overall protection.

Unit – I

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.

Unit – II

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.

Unit – III

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.

Unit – IV

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 geartooth wear and failure, tooth breakage, pitting, scoring, wear, overloading,gear-casing problems, lubrication failures

Unit – V

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

Course Outcome: the study of different gear are necessary to have an idea while designing the spur gear, helical gear, worm gear and Optimal Gear design

Text Books:

1. Maleev and Hartman, Machine Design, C.B.S. Publishers, India.
2. Henry E.Merrit,Gear engineering ,Wheeler publishing,Allahabad,1992.
3. Practical Gear design by Darle W. Dudley, McGraw-Hill book company

REFERENCES:

1. Earle Buckingham, Analytical mechanics of gears, Dover publications, New York, 1949.
2. G.M.Maitha, Hand book of gear design, TaTa Mc.Graw Hill publishing company Ltd., New Delhi,1994.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

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(17D04105) DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS
ELECTIVE -II

Course objective: power in Industry. Also to impart knowledge on the methodology of basic and advanced design of pneumatics and hydraulics systems. It helps students to get knowledge on the need, use and application of fluid power and make

UNIT I

OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS

Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.

UNIT II CONTROL AND REGULATION ELEMENTS

Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems.

UNIT III HYDRAULIC CIRCUITS

Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits - industrial circuits - press circuits - hydraulic milling machine - grinding, planning, copying, - forklift, earth mover circuits- design and selection of components - safety and emergency mandrels.

UNIT IV PNEUMATIC SYSTEMS AND CIRCUITS

Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods - step counter method - compound circuit design - combination circuit design.

UNIT V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS

Pneumatic equipments- selection of components - design calculations – application -fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

Course outcomes: them familiar to industrial design that lead to automation. To impart students on the science, use and application of hydraulics and pneumatics as fluid.

REFERENCES

1. Antony Espossito, "Fluid Power with Applications", Prentice Hall, 1980.
2. Dudleyt, A. Pease and John J. Pippenger, "Basic fluid power", Prentice Hall, 1987.
3. Andrew Parr, "Hydraulic and Pneumatics" (HB), Jaico Publishing House, 1999. 4. Bolton. W., "Pneumatic and Hydraulic Systems ", Butterworth –Heinemann, 1997. 5. K.Shanmuga Sundaram, "Hydraulic and Pneumatic Controls: Understanding made Easy" S.Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year I Sem. (Machine Design)

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(17D15108) SIMULATION LABORATORY

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 discretised with,2-D & 3-D elements

1. Static Analysis
2. Modal Analysis
3. Harmonic Analysis
4. Spectrum Analysis
5. Buckling Analysis
6. Analysis of Composites
7. Fracture mechanics

III. Thermal Analysis using any FEA Package for different structures that can be discretised with 1-D,2-D & 3-D elements

1. Steady state thermal analysis
2. Transient thermal analysis

IV. Transient analysis using any FEA Package for different structures that can be discretised with 1-D,2-D & 3-D elements

1. Linear
2. Non-Linear (Geometrical Non-linearity)

REFERENCES:

User manuals of ANSYS package Version 10.0
PRO/E,I-DEAS Package /UNIGRAPHICS,CATIA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (Machine Design)

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(17D04201) ADVANCED OPTIMIZATION TECHNIQUES

CourseObjectives: Many real-world problems require advanced techniques to formulate and to solve, and sometimes new optimization algorithms and procedures need to be designed. The objective of this class is to help students become optimizers, who have solid understanding of basic theory and also practical skills to model and solve real-world problems. Students will learn • a deeper understanding of the key concepts, theory, and algorithms of linear optimization, integer optimization, and some modern convex optimization, • more advanced modeling techniques, • ways of solving optimization problems that are too hard, too large for direction solution, • ways of solving optimization problems faster when speed is essential, • ways to assess the quality of sub-optimal solutions.

UNIT - I

Integer programming- cutting plane method and branch and bound technique, mixed integer programming

UNIT - II

Classical optimization techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method.

UNIT - III

Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation,

termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, solving differential equations using GP.

UNIT – IV

Multi-Objective Decision making: Introduction to goal programming , Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems .

Introduction to Analytical hierarchical process, analytical network process.

UNIT V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

Course outcomes:Understand the basic theory and some advanced topics in linear optimization, integer optimization, and convex optimization. 2. Identify the proper optimization technique(s) to attempt when problems are too large or too complicated to solve in a straightforward way. 3. Use optimization software and implement solution algorithms involving largescale optimization techniques.. 4. Handle large data sets that accompany real-world optimization problems.

Text Books:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers

2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers

3. Engineering Optimization – S.S.Rao, New Age Publishers

4. Operation Research by Hamdy A. Taha, Person publications

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers

2. Genetic Programming- Koza

3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (Machine Design)

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(17D15201) FRACTURE, FATIGUE & CREEP DEFORMATION

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.

UNIT-I

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.

UNIT-II

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.

UNIT-III

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,

UNIT-IV

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.

UNIT-V

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 parameters. Creep-fatigue interactions. Examples.

Course outcomes: Ability to use simple continuum mechanics and elasticity to determine the stresses, strains, and displacements in a loaded structure.
Understanding and mathematical modeling of the elements of plastic deformation, with respect to continuum and microscopic mechanisms.
Ability to use creep data to predict the life of structures at elevated temperatures and the understanding of mechanisms of creeep deformation and fracture.
Use of fracture mechanics to quantitatively estimate failure criteria for both elastically and plastically deforming structures, in the design of life prediction strategies, and for fracture control plans, with examples from automotive, aerospace, medical, and other industries.
Understanding of fatigue and how this affects structural lifetimes of components.
Design of metals, ceramics, composites, and biological materials for optimal failure and fatigue analysis.

TEXT BOOKS:

1. T.L. Anderson, Fracture Mechanics Fundamentals and Applications, 2nd Ed. CRC press, (1995)
2. B. Lawn, Fracture of Brittle Solids, Cambridge Solid State Science Series 2nd ed1993.
3. J.F. Knott, Fundamentals of Fracture Mechanics, Butterworths (1973)
4. J.F. Knott, P Withey, Worked examples in Fracture Mechanics, Institute of Materials.
5. H.L.Ewald and R.J.H. Wanhill Fracture Mechanics, Edward Arnold, (1984).
6. S. Suresh, Fatigue of Materials, Cambridge University Press, (1998)
7. L.B. Freund and S. Suresh, Thin Film Materials Cambridge University Press,(2003).
8. G. E. Dieter, Mechanical Metallurgy, McGraw Hill, (1988)
9. D.C. Stouffer and L.T. Dame, Inelastic Deformation of Metals, Wiley (1996)
10. F.R.N. Nabarro, H.L. deVilliers, The Physics of Creep, Taylor and Francis, (1995)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (Machine Design)

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(17D04202) INDUSTRIAL ROBOTICS & EXPERT SYSTEMS

Course objective: Create a team name and choose roles for each person on the team. You may use the roles we have in the class or create roles as a team. An explanation of roles must be described of your journal. Give an example of a task that role would perform and a quote of what they might say. (Be specific to robotics.) A list of who is assigned to each role will be on page 3 of the journa l. Remember, your grade will be based on how well you work together. All students have contributed equally.
We have the ability to use our hands and cognitive skills to work together. This course involves a cognitive understanding of the process of designing a robot. This class gives students a real life experience on what it takes to be a professional engineer.

UNIT I
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.

UNIT II
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.

UNIT III
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.

UNIT IV
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.

UNIT V

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.

Course outcomes: For each challenge you must design a blue print in your team log. This will allow you to see your original design and any changes you make in making sure your robot meet's its objective. Remember to label each part and explain how many you need of each part

Build the robot. You MUST create the blue prints while building the robot. This will enable you to see if you included everything you need on the blue print. If you find that as you are building your robot you need more parts, you also need to add those parts to the blue print.

TEXT BOOK: 1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing, Vision and Intelligence", Mc Graw Hill, 1987.

REFERENCES

1. Yoram Koren," Robotics for Engineers' Mc Graw-Hill, 1987.
2. Kozyrey, Yu. "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R." Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", Mc Graw-Hill, Int. 1986.
6. Timothy Jordanides et al ,"Expert Systems and Robotics ", Springer –Verlag, New York, May 1991.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (Machine Design)

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(17D15202) MECHANICAL VIBRATIONS

Course Objectives: Upon successful completion of this course, you will be able to understand basic and intermediate concepts necessary for the analysis of the dynamics of complex structures under various loading conditions. In particular, you will be able to: Syllabus ME 56300 – Mechanical Vibrations: Explain and correlate the structural properties of complex structures to the overall vibration characteristics in order to design systems having required dynamical properties. Apply theoretical and numerical procedures to predict the dynamic response of discrete or continuous structural systems under the most diverse loading conditions. Develop reduced order models to treat systems with a large number of DOF. Understand and implement approximate methods for the numerical solution of distributed parameter systems. Understand the main features of the dynamics of nonlinear lumped parameters systems.

Unit I

Single degree of Freedom systems: Undamped and damped free vibrations: forced vibrations ; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation ; Vibration isolation and transmissibility .

Response to Non Periodic Excitations: unit Impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

Unit II Vibration measuring instruments : Vibrometers, velocity meters & accelerometers

Two degree freedom systems: Principal modes – undamped and damped free and forced vibrations ; undamped vibration absorbers ;

Unit III

Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete-Time systems.

Unit IV

Numerical Methods: Rayliegh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods.

Unit V

Continuous systems: Free vibration of strings – longitudinal oscillations of bars-traverse vibrations of beams- Torsional vibrations of shafts.

Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

Course outcomes: The course will cover fundamental concepts on the vibration of mechanical systems including, but not limited to, review of systems with one degree for freedom, Lagrange's equations of motion for multiple degree of freedom systems, introduction to matrix methods, transfer functions for harmonic response, impulse response, and step response, convolution integrals for response to arbitrary inputs, principle frequencies and modes, applications to critical speeds, measuring instruments, isolation, torsional systems, introduction to nonlinear problems.

Text books:

1. Elements of Vibration Analysis by Meirovitch.
2. Mechanical Vibrations by G.K. Groover.

REFERENCES:

1. Vibrations by W.T. Thomson
2. Mechanical Vibrations – Schaum series.
3. Vibration problems in Engineering by S.P. Timoshenko.
4. Mechanical Viabrations – V.Ram Murthy.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (Machine Design)

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(17D15203) EXPERIMENTAL STRESS ANALYSIS
Elective-III

Course objective:

To bring awareness on experimental method of finding the response of the structure to different types of load.

Unit – I

Introduction: Theory of Elasticity, Plane stress and plane strain conditions, Compatibility conditions. Three-dimensional stress strain relations.

Strain Measurement Methods: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits, effect of poission ratio strain gauge results, measurements of residual strain general applications.

Unit – II

Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.

Unit – III

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

Unit – IV

Photo elasticity: Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics

Unit – V

Three dimensional Photo elasticity : Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear-difference method in three dimensions, applications of the Frozen-stress method, the scattered-light method.

Birefringent Coatings

Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

Course outcomes: The course covers the basic aspects of experimental stress analysis that includes exhaustive treatment of the most versatile techniques like photoelasticity and strain gauges and also a brief introduction to the emerging techniques like digital image correlation. In addition it also provides the fundamental aspects of six different experimental techniques such as Moiré, Brittle Coatings, Holography, Speckle Methods, Thermoelastic Stress Analysis and Caustics.

TEXT BOOKS :

1. Theory of Elasticity by Timoshenke and Goodier Jr
2. Experimental stress analysis by Dally and Riley,Mc Graw-Hill

REFERENCES:

1. A treatise on Mathematical theory of Elasticity by Love .A.H
2. Photo Elasticity by Frocht

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M. Tech – I year II Sem. (Machine Design)

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(17D15204) THEORY OF PLASTICITY
Elective-III

Course objectives: Student acquires information on elementary theory of plasticity inclusive the relationship between the external loading and non-linear permanent straining of hardened metallic isotropic and anisotropic continuum. The student will understand the fundamentals of progressive methods of metal forming process design, namely modeling and finite element simulation.

Unit – I

Introduction: Modeling Uniaxial behavior in plasticity. Index notation, Cartesian tensors.Yield and failure criteria Stress, stress deviator tensors. Invariants, principal, mean stresses. Elastic strain energy. Mohr's representation of stress in 2 & 3 dimensions. Haigh-Westergaard stress space. Equilibrium equations of a body. Yield criteria: Tresca's, von Mises rules, Drucker-Prager criterion, anisotropic yield criteria.

Unit – II

Strain at point: Cauchy's formulae for strains, principal strains, principal shear strains, derivative strain tensor. Strain-displacement relationships. Linear elastic stress strain relations, Generalized Hooke's law, nonlinear elastic stress strain relations

Principle of virtual work and its rate forms: Drucker's stability postulate, normality, convexity and uniqueness for an elastic solid. Incremental stress strain relations.

Unit – III

Criteria for loading and unloading: Elastic and plastic strain increment tensors, Plastic potential and flow rule associated with different Yield criteria, Convexity, normality and uniqueness considerations for elastic–plastic materials. Expansion of a thick walled cylinder.

Incremental stress strain relationships: Prandtl-Reuss material model. J_2 deformation theory, Drucker-Prager material, General Isotropic materials.

Unit – IV

Deformation theory of plasticity: Loading surface, Hardening rules. Flow rule and Druckers stability postulate. Concept of effective stress and effective strain, mixed hardening material. Problems.

Finite element formulation for an elastic plastic matrix: Numerical algorithms for solving non linear equations, Convergence criteria, Numerical implementations of the elastic plastic incremental constitutive relations.

Unit – V -

Bounding surface theory: Uniaxial and multiaxial loading anisotropic material behaviour Theroms of limit analysis : Statically admissible stress field and kinematically admissible velocity field. Upper and lower bound theorms, examples and problems.

Course outcomes: This is a postgraduate course aimed towards providing strong conceptual foundations for developing continuum theories of plastic deformation. In addition we develop several important formulations of plastic flow which are of much practical use in current industrial applications.

The course begins with a broad overview of plasticity. Next, all the pertinent concepts from continuum mechanics and thermodynamics are introduced. The general theory of plastic flow is then developed using the theory of continuous distribution of dislocations and irreversible thermodynamics.

Next we discuss the special cases when elasticity is either infinitesimal or absent. The concepts of associative flow rule, hardening, uniqueness, and stability are discussed in detail. We finish the lectures with an introduction to plastic waves.

Text books/References:

1. Plasticity for structural engineering W.F.Chen s and D.J.Han, Springer verlag-1987.
2. Mechanics of Materials –II, Victor E. Saouma

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M. Tech – I year II Sem. (Machine Design)	**L**	**T**	**P**	**C**
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(17D15205) APPLIED ENGINEERING ACOUSTICS
Elective-III

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.

UNIT I
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.

UNIT II
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.

UNIT III
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.

UNIT IV
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.

UNIT V
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.

Course outcomes:

At the end of this course, the students would be in a position to understand the basics of sound engineering, working principle of sound measuring equipments and different ways of acoustic control in the engineering field as acoustics is recognized as the major problem in engineering field today.

REFERENCES

1. Lawrence E. Kinsler, Austin R. Frey, "Fundamentals of Acoustics "– John Wiley and Sons Inc., 1986.
2. Bies, David, A. and Hansen, Colin H., "Engineering Noise Control – Theory and Practice", E and FN Spon, Chapman-Hall, Second Edition, 1996.
3. Hansen C.H. and Snyder, S.D., "Active Control of Sound and Vibration", E and FN Spon, London 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (Machine Design)

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(17D04109) DESIGN FOR MANUFACTURING
Elective-IV

Course Objectives:

Internalize the attributes along which the success or failure of a manufacturing process, machine, or system will be measured: quality, cost, rate and flexibility.

Provide exposure to a range of current industrial processes and practices used to manufacture products in high and low volumes. Focus in depth on a few selected processes.

Apply physics to understand the factors that control the rate of production and influence the quality, cost and flexibility of processes.

Understand the impact of manufacturing constraints on product design and process planning.

Apply an understanding of variation to the factors that control the production rate and influence the quality, cost and flexibility of processes and systems.

UNIT – I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.
Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNIT – II

Machining processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease – redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT – III

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

UNIT – IV

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

UNIT – V

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding

Course outcomes: Manufacturing is how we satisfy human need and create wealth. The challenge is to create a product that is responsive to the customer with high quality and low cost. A graduate should have the tools and confidence to go into a manufacturing enterprise that is using an unfamiliar process to make a product he/she has not seen, and yet be able to make intelligent decisions.

Text Books:

1. Design for manufacture, John cobert, Adisson Wesley. 1995
2. Design for Manufacture by Boothroyd,

REFERENCES:

1. ASM Hand book Vol.20

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (Machine Design)

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(17D15206) PRESSURE VESSEL DESIGN
Elective-IV

Course objectives:

To give exposure to various types of process equipments and their design.
To understand the different types of stresses and their effects in pressure vessel.
To understand the piping layout and the stresses acting on it.

Unit – I

Introduction: Materials-shapes of Vessels-stresses in cylindrical, spherical and arbitrary, shaped shells. Cylindrical Vessels subjected to internal pressure, wind load, bending and torque-ilation of pressure vessels-conical and tetrahedral vessels.

Theory of thick cylinders: Shrink fit stresses in built up cylinders-auto frettage of thick cylinders. Thermal stresses in Pressure Vessels.

Unit – II

Theory of rectangular plates: Pure bending-different edge conditions.

Theory circular plates: Simple supported and clamped ends subjected to concentrated and uniformly distributed loads-stresses from local loads. Design of dome bends, shell connections, flat heads and cone openings.

Unit – III

Discontinuity stresses in pressure vessels: Introduction, beam on an elastic foundation, infinitely long beam, semi infinite beam, cylindrical vessel under axially symmetrical loading, extent and significance of load deformations on pressure vessels, discontinuity stresses in vessels, stresses in a bimetallic joints, deformation and stresses in flanges.

Unit – IV

Pressure vessel materials and their environment: Introduction, ductile material tensile tests, structure and strength of steel, Leuder's lines, determination of stress patterns from plastic flow observations, behaviour of steel beyond the yield point, effect of cold work or strain hardening on the physical properties of pressure vessel steels, fracture types in tension, toughness of materials, effect of neutron irradiation of steels, fatigue of metals, fatigue crack growth, fatigue life prediction, cumulative fatigue damage, stress theory of failure of vessels subject to steady state and fatigue conditions.

Unit – V

Stress concentrations: Influence of surface effects on fatigue, effect of the environment and other factors on fatigue life, thermal stress fatigue, creep and rupture of metals at elevated temperatures, hydrogen embrittlement of pressure vessel steels, brittle fracture, effect of environment on fracture toughness, fracture toughness relationships, criteria for design with defects, significance of

fracture mechanics evaluations, effect of warm prestressing on the ambient temperature toughness of pressure vessel steels.

Design features: Localized stresses and their significance, stress concentration at a variable thickness transition section in a cylindrical vessel, stress concentration about a circular hole in a plate subjected to tension, elliptical openings, stress concentration, stress concentration factors for superposition, dynamic and thermal transient conditions, theory of reinforced openings, nozzle reinforcement, placement and shape, fatigue and stress concentration.

Course Outcomes: On completion of this course students will be able to: 1. Analyse thin plates and shells for various types of stresses. 2. Design shells, end closures and nozzles of pressure vessels using ASME codes. 3. Analyse piping systems.

Text Books:

1. Theory and design of modern Pressure Vessels by John F.Harvey, Van nostrand reihold company, New York.
2. Pressure Vessel Design and Analysis by Bickell, M.B.Ruizcs.

REFERENCES:

1. Process Equipment design- Beowll & Yound Ett.
2. Indian standard code for unfired Pressure vessels IS:2825.
3. Pressure Vessel Design Hand Book, Henry H.Bednar, P.E., C.B.S.Publishers, New Delhi.
4. Theory of plates and shells- Timoshenko & Noinosky.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (Machine Design)

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(17D15207) MECHANICS OF COMPOSITE MATERIALS
Elective-IV

Course objectives: The objective for this course is to develop an understanding of the linear elastic analysis of composite materials. This understanding will include concepts such as anisotropic material behavior and the analysis of laminated plates. The students will undertake a design project involving application of fiber reinforced laminates.

UNIT-I

Introduction to Composite Materials: Introduction ,Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber-Reinforced Composites and nature-made composites, and applications .

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

Processing methods: Autoclave, contact moulding, compression moulding, filament winding, man layup, pultrusion, vaccum assisted RTM .

UNIT-II

Macromechanical Analysis of a Lamina :Introduction ,Definitions: Stress, Strain ,Elastic Moduli,Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina,

UNIT-III

Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina Strength Failure Theories of an Angle Lamina : Maximum Stress Failure Theory Strength Ratio,Failure Envelopes,Maximum Strain Failure Theory ,Tsai–Hill Failure Theory, Tsai–Wu Failure Theory, Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress–Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress–Strain Relationships for an Angle Lamina

UNIT-IV

Micromechanical Analysis of a Lamina :Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi-Empirical Models ,Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion.

UNIT-V

Macromechanical Analysis of Laminates: Introduction , Laminate Code , Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate , Hygrothermal Effects in a Laminate, Warpage of Laminates

Failure, Analysis, and Design of Laminates : Introduction , Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues

Course Outcomes:

Students who successfully complete the course will demonstrate the following outcomes by tests, homework, and design project.

1. An ability to identify the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques.
2. An ability to predict the elastic properties of both long and short fiber composites based on the constituent properties.
3. An ability to rotate stress, strain and stiffness tensors using ideas from matrix algebra.
4. A basic understanding of linear elasticity with emphasis on the difference between isotropic and anisotropic material behavior.
5. An ability to analyze a laminated plate in bending, including finding laminate properties from lamina properties and find residual stresses from curing and moisture.
6. An ability to predict the failure strength of a laminated composite plate.
7. A knowledge of issues in fracture of composites and environmental degradation of composites.
8. An exposure to recent developments in composites, including metal and ceramic matrix composites.
9. An ability to use the ideas developed in the analysis of composites towards using composites in aerospace design.

Text Books:

1. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
2. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley- Interscience, New York, 1980.
3. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), By Autar K. Kaw ,Publisher: CRC

REFERENCES:

1. 1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1969.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (Machine Design)

L	T	P	C
0	0	3	2

(17D15208) MACHINE DYNAMICS LABORATORY

Experiments:

1. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils
2. Determination of steady state amplitude of a forced vibratory system
3. Static balancing using steel balls
4. Determination of the magnitude and orientation of the balancing mass in dynamic balancing
5. Field balancing of the thin rotors using vibration pickups.
6. Determination of the magnitude of gyroscopic couple, angular velocity of precession, and representation of vectors.
7. Determination of natural frequency of given structure using FFT analyzer
8. Diagnosis of a machine using FFT analyzer.
9. Direct kinematic analysis of a robot
10. Inverse kinematic analysis of a robot
11. Trajectory planning of a robot in joint space scheme.
12. Palletizing operation using Robot programming.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech III semester (Machine Design)

L	T	P	C
4	0	0	4

(17D20301) RESEARCH METHODOLOGY
(Elective V-OPEN ELECTIVE)

UNIT I

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.

UNIT II

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.

UNIT III

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

UNIT IV

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 – Multi-variate Analysis.

UNIT V

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.

Text Books:

1. Research Methodology:Methods And Techniques – C.R.Kothari, 2nd Edition,New Age International Publishers.
2. Research Methodology: A Step By Step Guide For Beginners- Ranjit Kumar, Sage Publications (Available As Pdf On Internet)
3. Research Methodology And Statistical Tools – P.Narayana Reddy And G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.

REFERENCES:

1. Scientists Must Write - Robert Barrass (Available As Pdf On Internet)
2. Crafting Your Research Future –Charles X. Ling And Quiang Yang (Available As Pdf On Internet)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech III semester (Machine Design)

L	T	P	C
4	0	0	4

(17D20302) HUMAN VALUES AND PROFESSIONAL ETHICS
(Elective V-OPEN ELECTIVE)

Unit I:

HUMAN VALUES:Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Spirituality.

Unit II:

ENGINEERING ETHICS: Senses of Engineering Ethics- Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg‟s theory- Gilligan‟s theory- Consensus and controversy – Models of professional roles- Theories about right action- Self interest - Customs and religion –Uses of Ethical theories – Valuing time –Co operation – Commitment.

Unit III :

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

UNIT IV:

ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK: Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing riskSafety and the Engineer- Designing for the safety- Intellectual Property rights(IPR).

UINIT V:

GLOBAL ISSUES: Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics .

Text Books :

1. "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
2. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
3. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGrawHill– 2003.
4. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
5. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran , Laxmi Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech III semester (Machine Design)

L	T	P	C
4	0	0	4

(17D20303) INTELLECTUAL PROPERTY RIGHTS
(Elective V-OPEN ELECTIVE)

UNIT – I

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.
Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.
Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V

New Development Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.
International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

TEXT BOOKS & REFERENCES:

1. Intellectual Property Right, Deborah. E. Bouchoux, Cengage Learing.
2. Intellectual Property Right – Nleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,

Jawaharlal Nehru TechnologicalUniversity Anantapur

(Established by Govt. of A.P., Act. No. 30 of 2008)

Ananthapuramu–515 002 (A.P) India

M.Tech. in Power Electronics CourseStructures and syllabi under R17 Regulations

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU (A.P.)
COURSE STRUCTURE AND SYLLABUS
(For Affiliated Engineering Colleges w.e.f. 2017-18 Admitted Batch)
M.TECH - POWER ELECTRONICS, POWER & INDUSTRIAL DRIVES, POWER ELECTRONICS & ELECTRICAL DRIVES and POWER ELECTRONICS AND DRIVES

M.Tech I Semester

S.No	Subject Code	Subject	L	T	P	C
1.	17D54101	Advanced Power Semiconductor Devices	4	-	-	4
2.	17D49102	Machine Modeling and Analysis	4	-	-	4
3.	17D54102	Solid-State DC Drives	4	-	-	4
4.	17D54103	Applications of Power Electronics to Power Systems	4	-		4
5.	17D49105 17D49103 17D54104	**Elective-I** 1. Modern Control Engineering & Principles of Optimal Control 2. Optimization & Heuristic search Techniques 3. Advanced Digital Signal Processing	4	-	-	4
6.	17D54105 17D54106 17D54107	**Elective-II** 1. FPGA based Digital System Design 2. Solid-state Lighting and Control 3. Hybrid Electric Vehicle Systems	4	-	-	4
7.	17D54108	Power Electronics and Simulation Lab	-	-	4	2
		TOTAL	**24**	**-**	**04**	**26**

M.Tech II Semester

S.No	Subject Code	Subject	L	T	P	C
1.	17D54201	Advanced Power Converters	4	-	-	4
2.	17D49202	Power Quality	4	-	-	4
3.	17D54202	Advanced Drives & Control	4	-	-	4
4.	17D54203	Renewable Energy Conversion Systems	4	-		4
5.	17D49205 17D54204 17D49207	**Elective-III** 1. Reactive Power Compensation and Management 2. Adaptive Control 3. HVDC & EHVAC Transmission Systems	4	-	-	4
6.	17D49208 17D54205 17D49210	**Elective-IV** 1. Distributed Generation & Micro Grid Control 2. Energy Efficient Electrical Systems 3. Intelligent Control Techniques	4	-	-	4
7.	17D54206	Electrical Drives and Simulation Lab	-	-	4	2
		TOTAL	**22**	**-**	**04**	**26**

M.Tech III Semester

S.No	Subject Code	Subject	L	T	P	C
1.	17D20301 17D20302 17D20303	**Elective – V** 1. Research Methodology 2. Human Values and Professional Ethics 3. Intellectual Property Rights	4	-	-	4
2.	17D54301	**Elective - VI (MOOCS)**	-	-	-	-
3.	17D54302	Comprehensive Viva-Voce	-	-	-	2
4.	17D54303	Seminar	-	-		2
5.	17D54304	Teaching Assignment	-	-	-	2
6.	17D54305	Project Work Part – I	-	-	-	4
		TOTAL	**04**	**-**	**-**	**14**

M.Tech IV Semester

S.No	Subject Code	Subject	L	T	P	C
1.	17D54401	. Project Work Part - II	-	-	-	12

Project Viva Voce Grades:

A: Satisfactory

B: Not Satisfactory

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D54101) ADVANCED POWER SEMICONDUCTOR DEVICES

COURSE OBJECTIVES:

The student will be able:

- 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.

SYLLABUS:

UNIT-I: 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.

UNIT-II: 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.

UNIT-III: 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) .

UNIT-IV: 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.

UNIT-V: 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.

Text books:

1. Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, Third Edition, New Delhi.
2. B.W. Williams 'Power Electronics: Devices, Drivers, Applications and Passive Components, Tata McGraw Hill.

Reference books:

1. Advanced power electronics converters by Euzeli dos santos, Edison R. da silva.
2. Fundamentals of Power Semiconductor Devices by B. Jayanth Baliga, Springer Press, 2008.

COURSE OUTCOMES:

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

- Understand the static and dynamic characteristics of current controlled power semiconductor devices.
- Understand the static and dynamic characteristics of voltage controlled power semiconductor devices.
- Select the devices for different power electronics applications.
- Understand the control and firing circuit for different devices.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D49102) MACHINE MODELING AND ANALYSIS

COURSE OBJECTIVES:

The student will be able:

- To Identifying the methods and assumptions in modeling of machines.
- To recognize the different frames for modeling of AC machines.
- To write voltage and torque equations in state space form for different machines.

SYLLABUS:

Unit I: Modeling and Analysis of DC Machine
Magnetically coupled circuits, Machine windings and air-gap MMF, winding inductances and voltage equations - Separately excited dc generators, Separately excited dc motors, inter connection of machines, transfer functions of dc machines, dc series motor, dc shunt machines, dc compound machines, linearization techniques for small perturbations, cross field machines, transfer functions of cross field machines, Electric braking of dc motors.

Unit-II: Reference Frame Theory: Introduction to transformations, equations of transformations, change of variables, transformation to an arbitrary reference frame, commonly used reference frames, transformation between reference frames, Steady-state phasor relationships and voltage equations.

Unit III: Modeling of Three Phase Induction Machines: Voltage and torque equations in machine variables, Voltage and torque equations in arbitrary reference frame, Steady-state analysis and its operation. Free acceleration characteristics viewed from various reference frames, dynamic performance during sudden changes in load torque, dynamic performance during a three-phase fault at the machine terminals.

Unit IV: Modeling of Synchronous Machine: Voltage and torque equations in machine variables, Voltage equations in arbitrary and rotor reference frame, torque equations in in substitute variable, Steady-state analysis and its operation - Dynamic performance of synchronous machine, three-phase fault, comparison of actual and approximate transient torque characteristics, Equal area criteria.

Unit V: Modeling of Brushless DC Machines: Voltage and torque equations in machine variables, Voltage and torque equations in rotor reference frame variables, Analysis of steady state operation, dynamic performance.

References:

1. **Analysis of Electric Machinery and Drive Systems**, Paul C.Krause , Oleg wasynezuk, Scott D.Sudhoff, 3rd Edition, WILEY-IEEE Press, 2013.
2. **Electrical Motor Drives: Modelling, Analysis and Control** by R. Krishnan, Prentice-Hall, 2001.
3. **Thyristor control of Electric Drives** by Vedam Subramanyam, TMH, 18th Re-print, 2008.

COURSE OUTCOMES:

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

- Develop the mathematical models of various machines like, induction motor and Synchronous machines using modeling equations.
- Analyze the developed models in various reference frames.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D54102) SOLID STATE DC DRIVES

COURSE OBJECTIVES:

The student will be able:

- To understand steady state operation and transient dynamics of a motor load system
- To study and analyze the operation of the converter / chopper fed DC drive, both qualitatively and quantitatively.
- To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.
- To understand the implementation of control algorithms using microcontrollers and phase locked loop.

UNIT-I: DC MOTORS AND DRIVE SYSTEMS: DC motor- Types, induced emf, speed-torque relations; Speed control – Armature and field speed control; Ward Leonard control – Constant torque and constant horse power operation - Introduction to high speed drives and modern drives.
Characteristics of mechanical system – dynamic equations, components of torque, types of load; Requirements of drives characteristics – multi-quadrant operation; Drive elements, types of motor duty and selection of motor rating.

UNIT-II: CONVERTER FED DC MOTORS CONTROL: Principle of phase control – Fundamental relations; Analysis of series and separately excited DC motor with single-phase and three-phase converters – waveforms, performance parameters, performance characteristics. Continuous and discontinuous armature current operations; Current ripple and its effect on performance; Operation with freewheeling diode; Implementation of braking schemes; Drive employing dual converter.

UNIT-III : CHOPPER FED DC MOTORS AND THEIR CONTROL: Introduction to time ratio control and frequency modulation; Class A, B, C, D and E chopper controlled DC motor – performance analysis, multi-quadrant control – Chopper based implementation of braking schemes; Multi-phase chopper; Related problems.

UNIT-IV: CLOSED LOOP CONTROL OF DC DRIVES: Modeling of drive elements – Equivalent circuit, transfer function of self, separately excited DC motors; Linear Transfer function model of power converters; Sensing and feeds back elements - Closed loop speed control – current and speed loops, P, PI and PID controllers – response comparison. Simulation of converter and chopper fed d.c drive.

UNIT-V: DIGITAL CONTROL OF D.C DRIVE: Phase Locked Loop and micro-computer control of DC drives – Program flow chart for constant horse power and load disturbed operations; Speed detection and gate firing.

TEXT BOOKS

1. Gopal K Dubey, “Power Semiconductor controlled Drives”, Prentice Hall Inc., New Yersy, 1989.
2. R.Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2003.

REFERENCES

1.Gobal K.Dubey, “Fundamentals of Electrical Drives”, Narosal Publishing House, New Delhi, 2001.
2.Bimal K.Bose “Modern Power Electronics and AC Drives”, Pearson Education (Singapore) Pte. Ltd., New Delhi, 2003.
3.Vedam Subramanyam, “Electric Drives – Concepts and Applications”, Tata McGraw-Hill publishing company Ltd., New Delhi, 2002.
4.P.C Sen “Thyristor DC Drives”, John wiely and sons, New York, 1981

5. Power Electronics By M. D. Singh

COURSE OUTCOMES:
After completion of the course, the student will be able to:

- Understand steady state operation and transient dynamics of a motor load system
- Analyze the operation of the converter / chopper fed DC drive, both qualitatively and quantitatively.
- Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.
- Understand the implementation of control algorithms using microcontrollers and phase locked loop.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D54103) APPLICATIONS OF POWER ELECTRONICS TO POWER SYSTEMS

COURSE OBJECTIVES:

Student will be able:

- To develop the understanding of uncompensated lines and their behavior 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.

SYLLABUS:

UNIT I: 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.

UNIT II: 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

UNIT III: 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.

UNIT IV: 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.

UNIT V: 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.

Text books:

1. Narain G. Hingorani, Laszlo Gyugyi, Understanding FACTS, IEEE press
2. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, Electrical Power Systems Quality, McGraw Hill,2003

Suggested Reading:

1. Y.H.Song, A.T.Johns, Flexible A.C.Transmission System, IEE, London, 1999

COURSE OUTCOMES:

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

- Choose proper controller for the specific application based on system requirements
- Understand various systems thoroughly and their requirements
- Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D49105) MODERN CONTROL ENGINEERING & PRINCIPLES OF OPTIMAL CONTROL (Elective – I)

COURSE OBJECTIVES:

The student will be able to:

- Learn about concepts of controllability, observability and Pole placement design
- Understand concepts of full order and reduced order observer designs
- Learn about model decomposition and robust control
- Understand optimal control problem and various functional
- Learn about state regulator and Riccati equation

Unit I

Review of State-space representation, Controllability - Pole assignment using State feedback – Ackerman's formula for feedback gain determination; Observability. Duality. Effect of state feedback on controllability and observability. Controllable subspace – decomposition of states into controllable and uncontrollable components.

Unit II

Design of full-order observer – Bass Gura algorithm. The separation principle - Combined observer – controller compensator. Design of reduced order observer. Unobservable subspace – decomposition of states into observable and unobservable components – Canonical decomposition theorem.

Unit III

Reducibility – realization of transfer function matrices. Model decomposition and decoupling by state feedback. Design of robust control system for asymptotic tracking and disturbance rejection using State variable equations. Transfer function interpretations – transfer function form of observer and state estimate feedback. State-space interpretation of internal model principle.

Unit IV

Introduction to optimal control, Calculus of variations: Fundamental concepts, functionals of single function, functional involving several independent functions, fixed end point problem, necessary and sufficient conditions for optimal control.

Unit V

Discrete-time linear state regulator – Algorithm for the solution, Use of observer in implementing the control law. Continuous-time linear state regulator – Matrix Riccati equation. Time invariant linear state regulator – the reduced matrix Riccati equation - An iterative method to solve the reduced matrix Riccati equation. Suboptimal linear regulator.

Text Books:

1. Modern Control Engineering, Katsuhiko Ogata, 5th Edition, Prentice Hall India, 1997
2. Modern Control System Theory, M. Gopal, Revised 2nd Edition, New Age International Publishers, 2005.
3. D.S. Naidu, Optimal control systems, CRC Press, First edition, 2002.

References:

1. Linear Systems, Thomas Kailath, Perntice Hall, 1980.
2. Control System Design, Graham C. Goodwin, StefanF. Graebe and Mario E. Salgado, Pearson Education, 2000.
3. Linear System Theory and Design, Chi-Tsong Chen, OXFORD University Press.

4. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 11th Edition, Pearson Edu India, 2009.
5. Donald E.Kirk, Optimal Control Theory an Introduction, Prentice - Hall Network series - First edition, 1970.

COURSE OUTCOMES:

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

- Learn about concepts of controllability, observability and Pole placement design
- Understand concepts of full order and reduced order observer designs
- Learn about model decomposition and robust control
- Understand optimal control problem and various functional
- Learn about state regulator and Riccati equation

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D49103) OPTIMIZATION & HEURISTIC SEARCH TECHNIQUES
(Elective – I)

COURSE OBJECTIVES:

The student will be able to:

- Learn about optimization problem and basic optimization issues
- Understand the concept of linear programming
- Learn about transportation problem and solution
- Understand unconstrained optimization techniques
- Acquire knowledge about various heuristic optimization techniques

UNIT – I : INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUES:

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II : LINEAR PROGRAMMING

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

UNIT – III : TRANSPORTATION PROBLEM

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems. One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method. Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

UNIT – IV: UNCONSTRAINED OPTIMIZATION TECHNIQUES

Univariate method, Random Search methods, Grid Search method, Pattern Directions, Powell's method, Simplex method, Gradient of a function, Steepest Descent (Cauchy) method, Conjugate Gradient (Fletcher-Reeves) method, Newton's method.

UNIT – V: HEURISTIC OPTIMIZATION TECHNIQUES

Meta heuristic search methods: Genetic Algorithm based optimization, Simulated Annealing Techniques, Swarm Intelligent Algorithms, PSO, etc.

TEXT BOOKS:

1. "Modern Heuristic Optimization Techniques" by Kwang Y. Lee, Mohamed A. El-Sharkawi
2."Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rdedition, 1998.
3. "Introductory Operations Research" by H.S. Kasene & K.D. Kumar, Springer(India), Pvt.LTd.

REFERENCES:

1. "Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3 rd edition, 1996.
2. Operations Research – by Dr. S.D.Sharma.
3. "Operations Research: An Introduction" by H.A. Taha, PHI Pvt. Ltd., 6thedition
4. Linear Programming by G. Hadley

COURSE OUTCOMES:

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

- Learn about optimization problem and basic optimization issues
- Understand the concept of linear programming
- Learn about transportation problem and solution
- Understand unconstrained optimization techniques
- Acquire knowledge about various heuristic optimization techniques

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
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(17D54104) ADVANCED DIGITAL SIGNAL PROCESSING

(Elective – I)

COURSE OBJECTIVES:

The student will be able to:

- Understand the basic concepts of digital signals and systems
- Learn about transformation techniques and Filter realizations
- Learn about design concepts of IIR and FIR filters
- Understand the concept of quantization and error analysis
- Learn about poly phase decomposition and various applications

UNIT-I:

Introduction, Analog-to-digital and Digital-to-Analog conversion, sampled and hold circuit, Continuous-time Fourier Transforms. Discrete-time signals and systems, Discrete-time Fourier transform- its properties and applications, Fast-Fourier Transform (in time-domain and Frequency domain) , IDFT and its properties.

UNIT-II: z- Transforms

Definition and properties, Rational z-transforms, Region of convergence of a rational z-Transform, The inverse z- Transform, z-Transform properties, Computation of the convolution sum of finite-length sequences, The transfer function. Digital Filter Structures, Block Diagram representation, Equivalent structures, Basic FIR Digital Filter structures, Basic IIR Digital Filter structures, Realization of Basic structures using MATLAB, All pass filters, Computational complexity of Digital filter structures.

UNIT III: IIR Digital Filter Design:

Preliminary considerations, Bilinear transformation method of IIR Filter design, Design of low pass IIR Digital filters, Design of High pass, Band pass and band stop IIR digital filters, Spectral Transformations of IIR filter, IIR digital filter design using MATLAB, Computer aided design of IIR digital filters.

UNIT IV:FIR Digital Filter Design:

Preliminary considerations, FIR filter design based on windowed Fourier series, Computer aided design of Equiripple Linear phase FIR filters, Design of Minimum phase FIR filters, FIR digital filter design using MATLAB, Design of computationally efficient FIR digital filters.

UNIT V: Analysis of Finite word length effects:

The quantization process and errors, quantization of Fixed point numbers, Quantization of floating point numbers, Analysis of coefficient quantization effects, Analysis of arithmetic round off errors, Low sensitivity digital filters, Reduction of product round off errors using error feedback, Round off errors in FFT algorithms. The basic sample rate alteration devices, Multi rate structures for sampling rate conversion, Multistage design of decimator and interpolator, The Polyphase decomposition, Arbitrary-rate sampling rate converter, Nyquist Filters and some applications of digital signal processing.

Text Books:

1. S.K. Mitra**, Digital Signal Processing**-, Tata McGraw-Hill, Third Edition, 2006.

2. B.P. Lathi, **Principle of Signal Processing and Linear Systems**, Oxford International Student Version, 2009

3. M. Mondal and A Asif, **Continuous and Discrete Time Signals and Systems**, Cambridge, 2007

References:

1. Li Tan, **Digital Signal Processing- Fundamentals and Applications**-, Indian reprint, Elsevier, 2008.

2. Alan V. Oppenheim, Ronald W. Schafer, and John R.Buck, **Discrete- Time Signal Processing**-, Pearson Edu, 2008.

COURSE OUTCOMES:

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

- Understand the basic concepts of digital signals and systems
- Learn about transformation techniques and Filter realizations
- Learn about design concepts of IIR and FIR filters
- Understand the concept of quantization and error analysis
- Learn about poly phase decomposition and various applications

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
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(17D54105) FPGA BASED DEGITAL SYSTEM DESIGN

(Elective – II)

COURSE OBJECTIVES:

The student will be able:

- To Design and optimize complex combinational and sequential digital circuits
- To Model combinational and sequential digital circuits by Verilog HDL
- To Design and model digital circuits with Verilog HDL at behavioral, structural, and RTL Levels
- To Develop test benches to simulate combinational and sequential circuits.
- To Understand the FPGA Architecture

SYLLABUS:

Unit-I: Introduction to FPGAs

Introduction, Field-programmable Gate Arrays, Programmability and DSP, History of the Microchip, Technology Offerings, Influence of Programmability, Challenges of FPGAs.

Unit -II: Verilog HDL Coding Style :

Lexical Conventions - Ports and Modules — Operators -Gate Level Modelling - System Tasks & Compiler Directives - Test Bench - Data Flow Modeling - Behavioral level Modeling -Tasks & Functions

Unit III: Verilog Modeling of Combinational & Sequential Circuits :

Behavioral, Data Flow and Structural Realization — Adders — Multipliers- Comparators - Flip Flops -Realization of Shift Register - Realization of a Counter- Synchronous and Asynchronous FIFO — Single port and Dual port RAM — Pseudo Random LFSR — Cyclic Redundancy Check

Unit IV: Synchronous sequential circuit:

State diagram-state table —state assignment-choice of flip-flops — Timing diagram —One hot encoding- Mealy and Moore state machines — Design of serial adder using Mealy and Moore state machines - State minimization — Sequence detection- Design of vending machine using One Hot Controller

Unit V: FPGA and its Architecture:

Types of Programmable Logic Devices- PLA & PAL- FPGA Generic Architecture. ALTERA Cyclone II Architecture — Timing Analysis and Power analysis using Quartus-II- SOPC Builder- NIOS-II Soft-core Processor- System Design Examples using ALTERA FPGAs — Traffic light Controller, Real Time Clock - Interfacing using FPGA: VGA, Keyboard, LCD.

Text Books:

1. S.Ramachandran," Digital VLSI System Design: A Design Manual for Implementation of Projects on FPGAs and ASICs Using Verilog" Springer Publication,2007

2. Samir Palnitkar,"Verilog HDL: A Guide to Digital Design and Synthesis" Prentice Hall, Second Edition,2003 3. Roger Woods,John McAllister,Gaye Lightbody,Ying Yi " FPGA-based Implementation of Signal Processing Systems" John Wiley & Sons, Ltd,2008.

References:

1. Charles H Roth, Jr "Digital Systems design using VHDL", Thomson Books/Cole 2. Wayne Wolf, "FPGA Based System Design", Prentices Hall Modern Semiconductor Design Serie 3. Mark Balch, "Complete Digital design — A Comprehensive Guide to Digital Electronics and Computer system Architecture," Mc Graw Hill, 2007

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

- Design and optimize complex combinational and sequential digital circuits
- Model combinational and sequential digital circuits by Verilog HDL
- Design and model digital circuits with Verilog HDL at behavioral, structural,
- and RTL Levels
- Develop test benches to simulate combinational and sequential circuits.
- Understand the FPGA Architecture

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (PE, PID, PEED and PED)

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(17D54106) SOLID STATE LIGHTING AND CONTROL

(Elective – II)

COURSE OBJECTIVES:

The student will be able:

- To introduce the concept of Solid State Lighting and to impart the skills necessary for implementing light emitting diode in various sectors of illumination.
- To Redesigning an existing office and educational facility with LED luminaire,

Unit-I:Fundamentals of lighting & terminologies

Generation of radiation, CCT, CRI & CT,Review of Light sources, Solid State Lighting Photons emission in LEDs,Life cycle of photon, Overall, Internal, External & Extraction efficiency of photons in LEDs,Optical characteristics of LED,Light escape cone and its relevance in LED design & Numerical Lambertian Radiation pattern .

UNIT-II : LEDs & White light generation : Role of extraction efficiency & methods to increase it Materials used for LEDs ,Different types of LEDs, manufacturing technology White light generation, Challenges & Issues, RGB LED – CIE x-y chromaticity diagram, Advantages & disadvantages , Electrical Characteristics of LED & dependence of photometry Driver circuits – linear regulators, resistive circuits & current mirror

UNIT-III : Driving Circuits for LEDs : Switching Regulators – Buck Converter

Boost Converter,Buck Boost Converter,SEPIC Converter,Numerical on Driver design for LEDs,Necessity of closed control loop & its considerations, closed loop control of LED, Dimming approaches.

UNIT-IV : Design of LED luminaires

Redesigning an existing office and educational facility with LED luminaire,Lighting quality and Energy conservation analysis of redesigned facility. OLEDs and its types, principle, advantages , disadvantages and application,AC LEDs and its challenges,Selecting components for drivers

UNIT-V : Application of LEDs:

Traffic lights, Automotive signage, Displays- Alphanumeric displays, Full color video displays,Medical Applications- phototherapy of neonatal jaundice, Photo dynamic therapy, photo synthesis- plant growing, photo bioreactors.

Text Books:

1. Arturas Zukauskus, Michael S. Shur and Remis Gaska, “Introduction to solid state lighting”, wiley interscience 2002.
2. Mohan Underland and Robbins, “ Power Electronic converters, Applications and Design”, John Wiley and sons, 1989

3. Patrick Mottier, “LEDs for Lighting Applications”, John Wiley & Sons, 2009

Reference Books

1. E Fred Schubert, “ Light emitting Diodes” (2nd Edition), Cambridge University press, 2006
2. Gilbert Held, “Introduction to Light Emitting Diode Technology and Applications”, CRC press, 2009
3. Application Notes from Texas Instruments, National semiconductors, Hitachi

COURSE OUTCOMES:

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

- Understand the concept of Solid State Lighting
- Implement light emitting diode in various sectors of illumination.
- Redesigning an existing office and educational facility with LED luminaire.

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M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
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(17D54107) HYBRID ELECTRIC VEHICLE SYSTEMS

(Elective – II)

COURSE OBJECTIVES:

Objectives of this course are to:

• Introduce the fundamental concepts, principles, analysis and design of hybrid and electric vehicles

• Introduce the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used, energy storage devices, etc.

SYLLABUS:

UNIT-I: Introduction to Hybrid Electric Vehicles: Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT-II: Hybrid Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT-III: Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT-IV: Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT-V: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

TEXT BOOKS:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design,CRC Press, 2004.
3. Ali Emadi,Advanced Electric Drive Vehicles, ,CRC Press, 2017

REFERENCE BOOKS:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
3. http://nptel.ac.in/syllabus/108103009

COURSE OUTCOMES:

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

- Get knowledge on hybrid electric vehicles
- Compare the advantages and disadvantages of hybrid electric vehicles over conventional vehicles
- Compare the merits and demerits of hybrid electric trains over electrical trains
- Know the different energy storage techniques
- Discuss the electric population, motor drive technologies
- Analyze the different types of energy management strategies

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M.Tech I year I Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
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(17D54108) POWER ELECTRONICS AND SIMULATION LAB

COURSE OBJECTIVES:

The student will be able:

- To understand the operation of Power Electronic converters
- To enable the students gain a fair knowledge on the programming and simulation of Power Electronics.

List of Experiments:

1. Single Phase Full Controlled Converter With R And R-L Loads
2. Single Phase AC Voltage Controller With R And R-L Loads
3. Single Phase Cycloconverter
4. McMurray Full Bridge Inverter
5. Thyristorised Chopper
6. Simulation of Three Phase Fully Controlled Converter with R and R-L Loads using MATLAB/PSIM.
7. Simulation of Three Phase AC Voltage Controller with R and R-L Loads using MATLAB/PSIM.
8. Simulation of Three Phase Inverter in 180^0 Conduction Mode with Star & Delta Connected loads.
9. Simulation of Choppers.
10. Simulation of Single Phase Cycloconverter

COURSE OUTCOMES:

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

- Understand the operation of Power Electronic converters
- Gain a fair knowledge on the programming and simulation of Power Electronics converters.

(Simulation software tools: Matlab/Simulink/PSPICE/PSIM)

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M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
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(17D54201) ADVANCED POWER CONVERTERS

COURSE OBJECTIVES:

The student will be able:

- To understand Principle of Operation Advanced Power Converters.
- To describe the operation of multi level inverters with switching strategies for high power applications.
- To comprehend the design of resonant converters and switched mode power supplies.

SYLLABUS:

UNIT-I: 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.

UNIT-II: 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.

UNIT-III: 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.

UNIT-IV: 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.

UNIT-V: 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.

TEXT BOOKS:

1. **Power Electronics** by Mohammed H. Rashid, Pearson Education, Third Edition.
2. **Fundamentals of Power Electronics** by Robert Warren Erickson and Dragan Maksimovic, Springer US, 2nd Edition, 2001.

COURSE OUTCOMES:

After taking this course, student will be able to:

- Understand Principle of Operation Advanced Power Converters.
- Develop and analyze various converter topologies.
- 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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
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(17D49202) POWER QUALITY

COURSE OBJECTIVES:

To make the student learn about:

- Understand the different power quality and power frequency problems in the power system.
- Analyzing the types and causes of Electrical transients.
- Various types of Harmonics their causes and effects on Power System.
- The Concept of Electromagnetic Interference and its impacts Power Quality and Power System.

SYLLABUS:

UNIT I: INTRODUCTION TO POWER QUALITY AND POWER FREQUENCY DISTURBANCE

Introduction to Power Quality - Power Quality Issues - Susceptibility Criteria - Role of Power Suppliers and Users - Power Quality Standards. Introduction to Power Frequency Disturbances - Common Power Frequency Disturbances - Cures for Low Frequency Disturbances - Voltage Tolerance Criteria.

UNIT II: ELECTRICAL TRANSIENTS

Introduction to Transients - Transient System Model - Examples of Transient Models and Their Response - Types and Causes of Transients - Examples of Transient Waveforms – Three Phase unbalance – single phase faults – phase to phase faults – two phase to ground faults – seven tips of three phase unbalanced sag.

UNIT III: HARMONICS

Definition of Harmonics - Odd and Even Order Harmonics - Harmonic Phase Rotation and Phase Angle – Causes of Voltage and Current Harmonics – Individual and Total Harmonic Distortion - Harmonic Signatures - Effect of Harmonics on Power System Devices - Guidelines for Harmonic Voltage and Current Limitation - Harmonic Current Mitigation.

UNIT IV: ELECTROMAGNETIC INTERFERENCE

Introduction to EMI - Frequency Classification - Electrical Fields - Magnetic Fields - EMI Terminology - Power Frequency Fields - High Frequency Interference - EMI Susceptibility - EMI Mitigation - Health Concerns of EMI.

UNIT V: POWER QUALITY PROBLEMS – EMI IMPACT

Introduction to Power Quality Measurements - Power Quality Measurement Devices - Power Quality Measurements - Test Locations - Test Duration - Instrument Setup - Instrument Guidelines

TEXT BOOKS:

1. Power quality by C. Sankaran, CRC Press
2. Electrical Power Systems Quality, Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H.Wayne Beaty, 2nd Edition, TMH Education Pvt. Ptd.

REFERENCE BOOKS:

1. Understanding Power quality problems by Math H. J. Bollen IEEE Press
2. Power quality enhancement using custom power devices by Arindam Ghosh,Gerard Ledwich,Kluwer academic publishers

COURSE OUTCOMES:

After completing the course, the student should be able to do the following:

- Understand the concepts of power quality and power frequency problems in the power system.
- Analyze different types of Electrical Transients and Harmonics along with their causes and effects.
- Understand the concept of Electromagnetic interference**.**
- Analyze the various effects of Electromagnetic Interference on Power Quality.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
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(17D54202) ADVANCED DRIVES & CONTROL

COURSE OBJECTIVES:

The student will be able:

- To understand principle operation of scalar control of ac motor and corresponding speed-torque characteristics
- To understand the vector control for ac motor drive (IM and SM)
- To explain the static resistance control and Slip power recovery drive
- To explain synchronous motor drive characteristics and its control strategies
- To understand the brushless dc motor principle of operation.

UNIT-I: Induction Motor- An Overview

Review of Steady-State Operation of Induction Motor, Equivalent Circuit Analysis, Torque-Speed Characteristics. Phase Controlled Induction Motor Drive, Stator Voltage Control of Induction Motor, Phase-Controlled Converter Fed Induction Motor, Power Circuit and Gating, Reversible Phase-Controlled Induction Motor Drive, Torque-Speed Characteristics.

UNIT-II: Voltage Source Inverter Fed Induction Motor Drive

Stator Voltage and Frequency Control of Induction Motor, Torque-Speed Characteristic Static Frequency Changers, PWM Inverter Fed Induction Motor Drive, Variable-Voltage Variable-Frequency Operation of Induction Motor, Constant E/f And V/f Control Schemes, Slip Regulation. Current Source Inverter Fed Induction Motor Drive, Stator Current and Frequency Control of Induction Motor, Auto Sequentially Commutated Inverter (ASCI), Power Circuit, Commutation, Phase Sequence Reversal, Regeneration, Steady-State Performance.

UNIT-III: Rotor Side Control of Slip-Ring Induction Motor

Slip-Power Recovery Schemes, Steady-State Analysis- Range of Slip, Equivalent Circuit, Performance Characteristics; Rating of Converters. Vector Control of Induction Motor, Principles of Vector Control, Direct Vector Control, Derivation of Indirect Vector Control, Implementation – Block Diagram, Estimation of Flux, Flux Weakening Operation.

UNIT-IV: Control of Synchronous Motor Drives

Synchronous Motor and Its Characteristics- Control Strategies-Constant Torque Angle Control-Power Factor Control, Constant Flux Control, Flux Weakening Operation, Load Commutated Inverter Fed Synchronous Motor Drive, Motoring and Regeneration, Phasor Diagrams.

Unit-V: PMSM and BLDC Drives

Characteristics of Permanent Magnet, Synchronous Machines With Permanent Magnet, Vector Control of PMSM- Motor Model and Control Scheme, Constant Torque Angle Control, Constant Mutual Flux Linkages, Unity PF Control. Modeling of PM Brushless Dc Motor, Drive Scheme, Commutation Torque Ripple, Phase Advancing.

TEXT BOOK:

1.R. Krishnan, **Electric Motor Drives Modeling, Analysis & control**, Pearson Education, 2001.

REFERENCE BOOKS:

1. B. K. Bose **Modern Power Electronics and AC Drives**, Pearson Publications-2001.
2. MD Murphy & FG Turn Bull, Pergaman press, **Power Electronics control of AC motors** 1stedition-1998.
3. G.K. Dubey **Fundamentals of Electrical Drives,** Narosa Publications -1995.

COURSE OUTCOMES:

After taking this course, student will be able to:

- Develop induction motor for variable speed operations using scalar and vector control techniques.
- Identify the difference between the rotor resistance control and static rotor resistance control method and significance of slip power recovery drives.
- Develop controllers for synchronous motor.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
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(17D54203) RENEWABLE ENERGY CONVERSION SYSTEMS

COURSE OBJECTIVES:

The student will be able:

- To create the awareness of energy conservation in students
- To identify renewable energy sources for electrical power generation
- To analyze different energy storage methods
- To have knowledge on environmental effects of energy conversion

SYLLABUS:

UNIT I:

SOLAR PHOTO VOLTAIC POWER AND THERMAL SYSTEMS: The PV cell, Module and array, equivalent electrical circuit, open circuit and short circuit current, i-v and p-v curves, array design. Energy collection, solar power plant, synchronous generator, commercial power plants

UNIT II:

FUNDAMENTAL OF WIND TURBINES: Historical back ground, power contained in wind, thermodynamics of wind energy, efficiency limit for wind energy conversion, maximum energy obtainable for a thrust-operated converter, types of wind energy conversion devices, some relevant definitions, aerodynamics, design of wind turbine rotor, power speed, torque-speed characteristics, wind turbine control systems, control strategy.

UNIT III:

GRID CONNECTED SYSTEMS: constant voltage, constant frequency generation, reactive power compensation, variable voltage, variable frequency generation, effect of wind generator on the network. Classification of schemes, operating area, induction generators, doubly fed induction generator, wound field synchronous generators, the permanent magnet generators.

UNIT IV:

INTEGRATION OF WIND FORMS IN TO THE POWER SYSTEM: Reactive power compensation-Static Var compensator- Static synchronous compensator-STATCOM and FSIG stability, HVAC connections, HVDC connections-LCC-HVDC, Vsc-HVDC, Multi terminal HVDC,HVDC Transmission-opportunities and challenges

UNIT V:

ENERGY STORAGE AND HYBRID ENRGY SYSTEMS: Battery, types of batteries, equivalent electrical circuit, performance characteristics, lead- acid battery, battery design, battery charging, charging regulators, battery management, flywheel. Diesel generator and photo-voltaic system, wind-diesel hybrid system, wind-Photo voltaic systems.

References:

1. **" Wind and solar Power Systems Design, analysis & Operation"** Mukund R. Patel CRC Taylor & Fracis- 2nd edition
2."**Wind Electrical Systems"** S.N.Bhadra, D. Kastha, S. Banerjee Oxford University press.
3 **"Wind energy generation modeling and control",** . Anaya-Lara, Jenkins et al John Wiley & Sons ,Ltd

COURSE OUTCOMES:

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

- Find different renewable energy sources to produce electrical power
- Estimate conventional energy sources to produce electrical energy
- Role-play the fact that the conventional energy resources are depleted
- Arrange Stored energy and to avoid the environmental pollution

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
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(17D49205) REACTIVE POWER COMPENSATION & MANAGEMENT
(Elective – III)

COURSE OBJECTIVES:

The student will be able:

- 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.

SYLLABUS:

UNIT-I: 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.

UNIT-II: 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.

UNIT-III: 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.

UNIT-IV: 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.

UNIT-V: 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.

TEXT BOOKS:

1. J.E.Miller, Reactive Power Control in Electric Power Systems, John Wiley and Sons, 1982 (Units I to IV).
2. D.M.Tagare, Reactive power Management, Tata McGraw Hill, 2004 (Units V toVIII).

COURSE OUTCOMES:

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

- Distinguish the importance of load compensation in symmetrical as well as un symmetrical loads
- Observe various compensation methods in transmission lines
- Construct model for reactive power coordination
- Distinguish demand side reactive power management & user side reactive power management

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D54204) ADAPTIVE CONTROL
(Elective – III)

COURSE OBJECTIVES:

The student will be able to:

- Understand the concept of adaptive control problem, basic models of adaptive control
- Learn about Self Tuning Regulator
- Learn about STR control mechanisms and LQG control
- Understand the concept of MRAS
- Learn about SOAS and Gain scheduling

Unit – I

Introduction, Block Diagram of an Adaptive System, Effects of Process Variations on System Performance, Types of Adaptive Schemes, Formulation of the Adaptive Control Problem, Least Squares Method and Regression Models for Parameter Estimation, Estimating Parameters in Models of Dynamic Systems, the Finite Impulse Response Model, The Transfer Function and Stochastic Model.

Unit – II

Block Diagram of Deterministic Self Tuning Regulator (STR), Pole Placement Design – Process Model, Causality Conditions. Indirect STRs – Estimation, Continuous - Time STRs, Direct STRs – Minimum Phase Systems, Adaptive Control Algorithm, Feed Forward Control, Non Minimum Phase Systems – Adaptive Control Algorithm, Algorithm For Hybrid STR.

Unit – III

Design of Minimum Variance and Moving - Average Controllers, Stochastic STR – Indirect STR, Algorithm for Basic STR, Theorems on Asymptotic Properties. Unification of Direct STRs, Generalized Direct Self Tuning Algorithm, Self Tuning Feed Forward Control. Linear Quadratic STR – Theorems on LQG Control, Algorithms for Indirect LQG – STRs Based on Spectral Factorization and Riccati Equation.

Unit –IV

Model Reference Adaptive System (MRAS), The MIT Rule, Block Diagram of an MRAS for adjustment of Feed Forward Gain based on MIT Rule. Adaptation Gain – Methods for determination. Design of MRAS using Lyapunov Theory – Block Diagram of an MRAS based on Lyapunov Theory for a First Order System. Proof of The Kalman – Yakubovich Lemma, Adjustment Rules for Adaptive Systems, Relation between MRAS and STR.

Unit – V

Gain Scheduling – Principle, Block Diagram, Design of Gain Scheduling Controllers, Nonlinear Transformations, Block Schematic of a Controller based on Nonlinear Transformations. Application of Gain Scheduling for Ship Steering, Flight Control. Self Oscillating Adaptive System (SOAS) – Principle, Block Diagram, Properties of The Basic SOAS, Procedure for Design of SOAS. Industrial Adaptive Controllers and applications.

Text books:

1. K.J.Astrom and Bjorn Wittenmark, Adaptive control, Pearson Edu., 2nd Edn.
2. Sankar Sastry, Adaptive control.

References

1. V.V.Chalam, Adaptive Control System - Techniques & Applications, Marcel Dekker Inc.
2. Miskhin and Braun, Adaptive control systems, MC Graw Hill
3. Karl Johan Åström, Graham Clifford Goodwin, P. R. Kumar, Adaptive Control, Filtering and Signal Processing.
4. G.C. Goodwin, Adaptive control.
5. Narendra and Anna Swamy, Stable Adaptive Systems.

COURSE OUTCOMES:

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

- Understand the concept of adaptive control problem, basic models of adaptive control
- Learn about Self Tuning Regulator
- Learn about STR control mechanisms and LQG control
- Understand the concept of MRAS
- Learn about SOAS and Gain scheduling

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D49207) HVDC & EHVAC TRANSMISSION SYSTEMS
(Elective – III)

COURSE OBJECTIVES:

To make the student learn about:

- HVDC and EHVAC systems and their applications.
- Different Harmonics suppression filters and their role in power systems.
- Various theories like Electrostatic field and Travelling Wave Theory
- How to control the Voltage in various systems for effective and efficient system.

SYLLABUS:

UNIT- I: INTRODUCTION TO HVDC SYSTEMS

Introduction, Basic means of control-power reversal-constant current versus constant voltage control-Desired features of control- Actual control characteristics - Constant minimum ignition angle control - constant current control - Constant extinction angle control-stability of control - Tap changer control - Frequency control.

UNIT - II: HARMONICS SUPRESSION FILTERS, INTERACTION BETWEEN AC AND DC SYSTEMS

Characteristic Harmonics-troubles caused by harmonics-definitions of wave distortion or ripples –means of reducing harmonics-design of AC filters –Dc side filters- Voltage interaction –DC power modulation – Power frequency control-Large signal modulation – active and reactive power coordination.

UNIT – III: EHVAC TRANSMISSION SYSTEM

Introduction to EHVAC, Line inductance and capacitances – Sequence inductances and capacitances – Modes of propagation – Ground return – Examples. Electrostatics – Field of sphere gap – Field of line changes and properties – Charge – potential relations for multi-conductors – Surface voltage gradient on conductors – Distribution of voltage gradient on sub-conductors of bundle – Examples.

UNIT – IV: ELECTRO STATIC FIELD & TRAVELING WAVE THEORY

Electrostatic field: calculation of electrostatic field of EHV/AC lines – Effect on humans, animals and plants – Electrostatic induction in unenergised double circuit line - Electromagnetic interference - Examples. Traveling wave expression and solution - Source of excitation - Terminal conditions - Open circuited and short circuited end - Reflection and refraction coefficients - Lumped parameters of distributed lines - Generalized constants - No load voltage conditions and charging current.

UNIT –V: VOLTAGE CONTROL

Introduction to Voltage Control - Power circle diagram and its use – Voltage control using synchronous condensers – Cascade connection of shunt and series compensation – Sub synchronous resonance in series capacitor – Compensated lines – Static VAR compensating system.

TEXT BOOKS:

1. R. D. Begamudre, EHVAC Transmission Engineering, New Age International (p) Ltd.
2. S. Rao, HVAC and DC Transmission.
3. HVDC power Transmission systems by K.R.Padiyar 2nd edition, Wiley Eastern limited.

REFERENCE BOOKS:

1. High voltage direct current transmission by J.Arrilaga, IEE power engineering series.
2. Direct current transmission by E.W.Kimbark, Vol-1, Wiley inter science-New york.

COURSE OUTCOMES:

After completing the course, the student should be able to do the following:

- Understand the basics of HVDC and EHVAC systems and their characteristics.
- Analyze different types of Harmonic suppression Filters and also the interaction between AC and DC Systems due to the presence of harmonics.
- Analyze the impacts of electrostatic field and travelling wave on the system.
- Understand the different methods to Control the Voltage of the system at various points of power system.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D49208) DISTRIBUTED GENERATION & MICROGRID CONTROL (Elective – IV)

COURSE OBJECTIVES:

The student able to learn about:

- Able to know about the concept of distributed generation, distribution network & the concept of Microgrid, its configuration, advantages & limitations.
- Able to understand the basic concepts in combined heat and power, Wind energy conversion systems, solar photovoltaic systems & other renewable energy sources.
- Able to analyze the impact of Microgrid & Active distribution network management system on various factors.
- Able to know the effect of SCADA & understand the concept of Power quality disturbances, improvement technologies & issues of premium power in DC integration.

SYLLABUS:

UNIT I: INTRODUCTION TO DISTRIBUTED GENERATION AND MICROGRID CONCEPT

Introduction to distributed generation - Active distribution network - Concept of Microgrid - Microgrid configuration - Interconnection of Microgrids - Technical and economical advantages of Microgrid - Challenges and limitations of Microgrid development - Management and operational issues of a Microgrid - Dynamic interactions of Microgrid with main grid – low voltage DC grid.

UNIT II: DISTRIBUTED ENERGY RESOURCES

Introduction - Combined heat and power (CHP) systems: Micro-CHP systems - Wind energy conversion systems (WECS): Wind turbine operating systems - Solar photovoltaic (PV) systems: Classification of PV cell - Small-scale hydroelectric power generation - Other renewable energy sources - Storage devices.

UNIT III: MICROGRID AND ACTIVE DISTRIBUTION NETWORK MANAGEMENT SYSTEM

Introduction - Impact on heat utilisation - Impact on process optimisation - Impact on market - Impact on environment - Impact on distribution system - Impact on communication standards and protocols - Network management needs of Microgrid - Microsource controller - Central controller.

UNIT IV: SCADA AND ACTIVE DISTRIBUTION NETWORKS

Introduction - Existing DNO SCADA systems - Control of DNO SCADA systems - SCADA in Microgrids - Human–machine interface (HMI) - Hardware components - Communication trends in SCADA - Distributed control system (DCS) - Sub-station communication standardization - SCADA communication and control architectures - Communication devices.

UNIT V: IMPACT OF DG INTEGRATION ON POWER QUALITY AND RELIABILITY

Introduction - Power quality disturbances - Power quality sensitive customers - Power quality improvement technologies - Impact of DG integration - Issues of premium power in DG integration.

TEXT BOOK:

1. S. Chowdhury, S.P. Chowdhury and P. Crossley, "Microgrids and Active Distribution Networks", The Institution of Engineering and Technology, 2009.

COURSE OUTCOMES: Student acquire knowledge about:

- Understand the concept of distributed generation, distribution network & the concept of Microgrid, its configuration, advantages & limitations.
- Understand the basic concepts in combined heat and power, Wind energy conversion systems, Solar photovoltaic systems & other renewable energy sources.
- The impact of Microgrid & Active distribution network management system on various factors is known.
- Understand the effect of SCADA & understand the concept of Power quality disturbances, improvement technologies & issues of premium power in DC integration.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D54205) ENERGY EFFICIENT ELECTRICAL SYSTEMS

(Elective – IV)

Course objectives: Student learnt about:

- To analyse the concepts of Electricity billing and electrical load management.
- To understand the types of electrical products and systems that can lose energy.
- Learn how to measure energy loss.
- Able to know how to select and size equipment for the application.

SYLLABUS:

UNIT-I:

ELECTRICAL SYSTEM: Electricity billing, Electrical load management and maximumdemand control, Power factor improvement and its benefits, Selection and location of capacitors, Performance assessment of PF capacitors, Distribution and transformer losses.

UNIT-II:

ELECTRIC MOTORS: Types, Losses in electric motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving methods in electric motors.

UNIT-III:

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.

UNIT-IV:

Electric Drives: Maximum demand controllers, energy efficient drives, soft-starters with energy saver, variable speed drives, energy efficient techniques in drives.

UNIT-V:

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.

TEXT BOOKS:

1. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,.Logman Scientific & Technical, ISBN-0-582-03184, 1990.

REFERENCE:

1. Power System Engineering 2nd Ed. D P Kothari, I J Nagrath, 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, First Edition, 1990, by TD Eastop and DR Croft,Longman Group UK Ltd.
5. www.bee-india.nic.in (Guide on Energy Efficient room Air conditioners)

COURSE OUTCOMES:

- Analysed the concept of Electricity billing and electrical load management.
- Understand the types of electrical products and how the systems can lose energy.
- Measuring of energy loss is known.
- Understand how to select and size equipment for the application.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D49210) INTELLIGENT CONTROL TECHNIQUES
(Elective – IV)

COURSE OBJECTIVES:

The student will be able to:

- Learn about basic concepts of AI
- Understand concepts of ANN and various learning algorithms
- Learn about Genetic Algorithm, ACO and Tabu search concepts
- Understand the concepts of Fuzzy
- Learn about Fuzzy logic controller and design using MATLAB

UNIT I: Introduction to control techniques, need of intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule - based systems, the AI approach. Knowledge representation. Expert systems. Data Pre - Processing: Scaling, Fourier transformation, principal - component analysis and wavelet transformations.

UNIT II

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch - Pitts neuron model, simple perceptron, Adaline and Madaline, Feed - forward Multilayer Perceptron. Learning and Training the neural network. Networks: Hopfield network, Self - organizing network and Recurrent network. Neural Network based controller, Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab / Neural Network toolbox.

UNIT III

Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other than GA search techniques like tabu search and ant - colony search techniques for solving optimization problems.

UNIT IV

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to Fuzzy logic modeling and control of a system. Fuzzification, inference and defuzzification. Fuzzy knowledge and rule bases.

UNIT V

Fuzzy modeling and control schemes for nonlinear systems. Self - organizing fuzzy logic control. Implementation of fuzzy logic controller using Matlab fuzzy - logic toolbox. Stability analysis of fuzzy control systems. Intelligent Control for SISO/MIMO Nonlinear Systems. Model Based Multivariable Fuzzy Controller.

Text Books:

1. Simon Haykins, Neural Networks: A comprehensive Foundation, Pearson Edition, 2003.
2. T.J.Ross, Fuzzy logic with Fuzzy Applications, Mc Graw Hill Inc, 1997.
3. David E Goldberg, Genetic Algorithms.

References:

1. M.T.Hagan, H. B. Demuth and M. Beale, Neural Network Design, Indian reprint, 2008.
2. Fredric M.Ham and Ivica Kostanic, Principles of Neurocomputing for science and Engineering, McGraw Hill, 2001.

3. N.K. Bose and P.Liang, Neural Network Fundamentals with Graphs, Algorithms and Applications, Mc - Graw Hill, Inc. 1996.
4. Yung C. Shin and Chengying Xu, Intelligent System - Modeling, Optimization and Control, CRC Press, 2009.
5. N.K.Sinha and Madan M Gupta, Soft computing & Intelligent Systems - Theory & Applications, Indian Edition, Elsevier, 2007.
6. John Yen and Reza Langari, Fuzzy logic Intelligence, Control, and Information, Pearson Education, Indian Edition, 2003.
7. Witold Pedrycz, Fuzzy Control and Fuzzy Systms, Overseas Press, Indian Edition, 2008.

COURSE OUTCOMES:

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

- Learn about basic concepts of AI
- Understand concepts of ANN and various learning algorithms
- Learn about Genetic Algorithm, ACO and Tabu search concepts
- Understand the concepts of Fuzzy
- Learn about Fuzzy logic controller and design using MATLAB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (PE, PID, PEED and PED)	**L**	**T**	**P**	**C**
	0	**0**	**4**	**2**

(17D54206) ELECTRICAL DRIVES AND SIMULATION LAB

COURSE OBJECTIVES:

The student will be able to:

- Understand the operation of Power Electronic Drives.
- Enable the students gain a fair knowledge on the simulation of Power Electronics Drives.

List of Experiments:

1. 1-Phase AC input Thyristorised DC Drive with Closed Loop Control.
2. 3-Phase AC input Thyristorised DC Drive with Closed Loop Control.
3. Four Quadrant Chopper fed PMDC Motor Drive with Speed Closed Loop Control.
4. 1-Phase AC Induction Motor Speed Control using Cyclo Converter.
5. 3-Phase AC Wound Rotor Induction Motor Speed Control from rotor side.
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.

COURSE OUTCOMES:

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

- Understand the operation of Power Electronic Drives.
- Acquire skills of computer packages, MATLAB coding and SIMULINK in power electronics drives

(Simulation software tools: Matlab/Simulink/PSPICE/PSIM)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech III semester (PE, PID, PEED and PED)

L	T	P	C
4	0	0	4

(17D20301) RESEARCH METHODOLOGY

(Elective V-OPEN ELECTIVE)

UNIT I

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.

UNIT II

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.

UNIT III

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

UNIT IV

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 – Multi-variate Analysis.

UNIT V

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.

Text Books:

1. Research Methodology:Methods And Techniques – C.R.Kothari, 2nd Edition,New Age International Publishers.
2. Research Methodology: A Step By Step Guide For Beginners- Ranjit Kumar, Sage Publications (Available As Pdf On Internet)
3. Research Methodology And Statistical Tools – P.Narayana Reddy And G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.

REFERENCES:

1. Scientists Must Write - Robert Barrass (Available As Pdf On Internet)

2. Crafting Your Research Future –Charles X. Ling And Quiang Yang (Available As Pdf On Internet)

M.Tech III semester (PE, PID, PEED and PED)

L	T	P	C
4	0	0	4

(17D20302) HUMAN VALUES AND PROFESSIONAL ETHICS

(Elective V-OPEN ELECTIVE)

Unit I:

HUMAN VALUES:Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Spirituality.

Unit II:

ENGINEERING ETHICS: Senses of Engineering Ethics- Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg‟s theory- Gilligan‟s theory- Consensus and controversy – Models of professional roles- Theories about right action- Self interest - Customs and religion –Uses of Ethical theories – Valuing time –Co operation – Commitment.

Unit III :

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

UNIT IV:

ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK: Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing riskSafety and the Engineer- Designing for the safety- Intellectual Property rights(IPR).

UINIT V:

GLOBAL ISSUES: Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics .

Text Books :

1. “Engineering Ethics includes Human Values” by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.

2. “Engineering Ethics” by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

3. “Ethics in Engineering” by Mike W. Martin and Roland Schinzinger – Tata McGrawHill– 2003.

4. “Professional Ethics and Morals” by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.

5. “Professional Ethics and Human Values” by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran , Laxmi Publications.

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M.Tech III semester (PE, PID, PEED and PED)

L	T	P	C
4	0	0	4

(17D20303) INTELLECTUAL PROPERTY RIGHTS

(Elective V-OPEN ELECTIVE)

UNIT – I

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.

Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.

Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V

New Development Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.

International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

TEXT BOOKS & REFERENCES:

1. Intellectual Property Right, Deborah. E. Bouchoux, Cengage Learing.

2. Intellectual Property Right – Nleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,

Jawaharlal Nehru TechnologicalUniversity Anantapur

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Ananthapuramu–515 002 (A.P) India

M.Tech. in VLSI Design

Course Structures and Syllabi under R17 Regulations

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU (A.P.)
COURSE STRUCTURE AND SYLLABUS
(For Affiliated Engineering Colleges w.e.f. 2017-18 Admitted Batch)

M.Tech-ECE-VLSI, VLSI SYSTEMS, VLSI SYSTEM DESIGN (VLSI, VLSIS, VLSISD)

M.Tech I Semester

S.No	Subject Code	Subject	L	T	P	C
1.	17D06101	Structural Digital System Design	4	-	-	4
2.	17D57101	Advanced MOSFET Modeling	4	-	-	4
3.	17D57102	CMOS Analog IC Design	4	-	-	4
4.	17D57103	CMOS Digital IC Design	4	-		4
5.	 17D57104 17D06103 17D57105	**Elective-I** a. VLSI Signal Processing b. Advanced Computer Architecture c. CAD for VLSI	3	-	-	3
6.	 17D06202 17D55206 17D57106	**Elective-II** a. CPLD and FPGA Architectures and Applications b. ASIC Design c. Optimization Techniques in VLSI Design	3	-	-	3
7.	17D38107	Structural Digital System Design Lab	-	-	3	2
8.	17D57107	VLSI System Design Lab - I	-	-	3	2
		Total	**22**	**-**	**06**	**26**

M.Tech II Semester

S.No	Subject Code	Subject	L	T	P	C
1.	17D57201	Low Power VLSI Design	4	-	-	4
2.	17D57202	CMOS Mixed signal Design	4	-	-	4
3.	17D06201	Embedded System Design	4	-	-	4
4.	17D06109	Test and Testability	4	-		4
5.	 17D55201 17D57203 17D57204	**Elective-III** a. System On Chip Architecture b. Semiconductor Memory Design and Testing c. RF IC Design	3	-	-	3
6.	 17D38202 17D55204 17D57205	**Elective-IV** a. Internet of Things b. Hardware and Software Co-design of Embedded System c. Physical Design Automation	3	-	-	3
7.	17D38208	Embedded System Design Lab	-	-	3	2
8.	17D57206	VLSI System Design Lab - II	-	-	3	2
		Total	**22**	**-**	**06**	**26**

M.Tech. II YEAR (III Semester)

S. No	Course Code	Subject	L	T	P	C
1.	17D20301 17D20302 17D20303	Elective – V (Open Elective) 1. Research Methodology 2. Human Values & Professional Ethics 3. Intellectual Property Rights	4	---	---	4
2.	17D57301	ELECTIVE – VI (MOOCs)	--	---	---	--
3.	17D57302	Comprehensive Viva Voce	--	---	---	2
4.	17D57303	Seminar	--	---	---	2
5.	17D57304	Teaching Assignment	--	---	---	2
6.	17D57305	Project Work Phase I	--	---	---	4
	Total		4			14

M.Tech. II YEAR (IV Semester)

S. No	**Course Code**	**Subject**	**L**	**T**	**P**	**C**
1.	17D57401	Project Work Phase II	--	---	---	12
	Total					**12**

Project Viva Voce Grades:

A: Satisfactory

B: Not Satisfactory

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D06101) STRUCTURED DIGITAL SYSTEM DESIGN

Course Objective:

- To study about structural functionality of different Digital blocks (Both combinational and Sequential)
- To provide an exposure to ASM charts, their notations and their realizations.
- To provide an exposure to VHDL and different styles of modeling using VHDL.
- To introduce the concept of micro programming and study issues related to micro programming

Course Outcome:

After Completion of this course, students will be able to

- Understand structural functionality of different digital blocks
- Represent and Realize their designs in ASM charts
- Represent their designs in different modeling styles by using VHDL
- Understand concept of Micro program and issues related to micro programming

UNIT-1

BUILDING BLOCKS FOR DIGITAL DESIGN: Multiplexer, Demultiplexer, Decoder, Encoder, Comparator, Adder, ALU, Carry-look-ahead adder.

BUILDING BLOCKS WITH MEMORY: Clocked building blocks, register building blocks, RAM, ROM, PLA, PAL, Timing devices.

UNIT -II

DESIGN METHODS: Elements of design style, top-down design, separation of controller and architecture, refining architecture, and control algorithm, Algorithmic State Machines, ASM chart notations.

UNIT-III

REALISING ASMS - Traditional synthesis from ASM chart, multiplexer controller method, one-shot method, ROM based method.

ASYNCHRONOUS INPUTS AND RACES - Asynchronous ASMs, Design for testability, test vectors, fault analysis tools.

UNIT-IV

MICROPROGRAMED DESIGN: Classical Microprogramming with Modem Technology; Enhancing the Control Unit; The 2910 Microprogram Sequencer; Choosing a Microprogram Memory; A Development System for Microprogramming; Designing a Microprogrammed Minicomputer

UNIT-V

MODELLING WITH VHDL: CAD tools, simulators, schematic entry, synthesis from VHDL.

DESIGN CASE STUDIES: Single pulse, system clock, serial to parallel data conversion, traffic light controller.

TEXT BOOKS:

1. Franklin P. Prosser and David E. Winkel, "The Art of Digital Design", Prentice Hall.
2. Roth, “Digital System Design using VHDL”, Mc. Graw Hill, 2000

REFERENCE BOOKS:

1. William Fletcher, An Engineering Approach to Digital Design, 1st Edition, Prentice-Hall India, 1997.
2. William J Dally and John W Poulton, Digital Systems Engineering, Cambridge University Press, 2008.
3. Jayaram Bhasker, A VHDL Primer, 3rd edition, Prentice-Hall India, 2009.
4. VHDL for Programmable Logic - Kevin Skahill, Cypress Semiconductors

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D57101) ADVANCED MOSFET MODELING

Course Outcomes:

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

- Derive mathematical models for modern MOS devices.
- Provide solution to overcome short channel issues.
- Create various compact models appropriate for industry.

UNIT I

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.

UNIT II

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.

UNIT III

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.

UNIT IV

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.

UNIT V

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.

TEXT BOOKS:

1. Taur and T. H. Ning, ―Fundamentals of Modern VLSI Devices‖, Cambridge University Press, Cambridge, United Kingdom, 1998.
2. TrondYtterdal, Yuhua Cheng and Tor A. FjeldlyWayne Wolf, ―Device Modeling for Analog and RF CMOS Circuit Design‖, John Wiley & Sons Ltd,2003.
3. B. G. Streetman and S. Banarjee, ―Solid State Electronic Devices 6th edition‖, Prentice Hall of India Pvt. Ltd, New Delhi, India, 2005.

4. N. DasGupta and A. DasGupta, ―Semiconductor Devices – Modeling and Technology‖, Prentice Hall of India Pvt. Ltd, New Delhi, India, 2004.

REFERENCE BOOKS:

1. A. B. Bhattacharyya, ―Compact MOSFET Models for VLSI Design‖, John Wiley & Sons Inc., 2009.
2. C. K. Maiti, N. B. Chakrabarti, S. K. Ray, "Strained silicon hetero structures: materials and devices‖, The Institution of Electrical Engineers, London, United Kingdom, 2001.
3. WeidongLiuandChemmingHu‖BSIM 4 and MOSFET Modeling for IC simulation‖, World scientific and Publishing Co. Pte. Ltd.2011

WEB REFERENCE BOOKS:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D57102) CMOS ANALOG IC DESIGN

Course Outcomes:

After completion of the course the students will be able to

- Understand significance of different biasing styles and apply them for designing analog ICs.
- Analyze the functionality of Current Mirrors, Current Sinks, Differential amplifiers and Current amplifiers.
- Design basic building blocks of analog ICs like, current mirrors, current sources, current sinks, two stage CMOS Power amplifiers and comparators.

UNIT –I

MOS Devices and Modeling: The MOS Transistor, Passive Components-Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT –II

Analog CMOS Sub-Circuits: MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage REFERENCE BOOKS, Band gap Reference.

UNIT –III

CMOS Amplifiers: Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures, Mismatch-offset cancellation techniques, Reduction of Noise by offset cancellation techniques, Alternative definition of CMRR.

UNIT –IV

CMOS Operational Amplifiers: Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT –V

Comparators: Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

TEXT BOOKS:

1. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition.
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

REFERENCE BOOKS:

1. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn, 2013.
2. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce,
3. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D57103) CMOS DIGITAL IC DESIGN

Course Outcomes:

After completion of the course the students will be able to

- Design CMOS inverters with specified noise margins and propagation
- Complete knowledge regarding the different issues associated with organization and design of semiconductor memories
- Realize and implement basic combinational and sequential elements that are commonly observed in digital ICs.
- Design basic combinational and sequential elements using NMOS and CMOS design strategies.
- Analyze the dynamic performance of CMOS circuits

UNIT-I

MOS Design Pseudo NMOS Logic: Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT-II

Combinational MOS Logic Circuits: MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates , AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

UNIT-III

Sequential MOS Logic Circuits: Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

UNIT-IV

Dynamic Logic Circuits: Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

UNIT-V

Semiconductor Memories: Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory-NOR flash and NAND flash

TEXT BOOKS:

1. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.
2. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, AnanthaChandrakasan,

BorivojeNikolic, 2nd Ed., PHI.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(17D57104) VLSI SIGNAL PROCESSING

Elective-I

Course Outcomes:

After completion of the course the students will be able to

- Get in depth knowledge on signal processing system and various techniques of power reduction.
- Realize various adders, multipliers and filters and optimize their operation of by reducing the redundant operations
- Apply concept of pipelined architecture for various combinational and sequential circuit modules like adders, multipliers, filters
- Design Low Power IIR filters

UNIT-I

Transformations for retiming.Folding and unfolding DSP programs.

UNIT-II

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.

UNIT-III

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.

UNIT-IV

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.

UNIT-V

Scaling versus power consumption. Power analysis, power reduction techniques, power estimation techniques. Low power IIR filter design .Low power CMOS lattice IIR filter.

TEXT BOOKS:

1. K.K. Parhi : VLSI Digital Signal Processing systems, 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, YannisTsividis, 1994, Prentice Hall.
2. VLSI Digital Signal Processing – Medisetti V. K, 1995, IEEE Press (NY), USA.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(17D06103) ADVANCED COMPUTER ARCHITECTURE

Elective-I

Course Outcomes:

After completion of the course the students will be able to

- Know about different parallel computer models and their network properties.
- Understand about different concepts related to pipelining and super scalar techniques.
- Get complete knowledge regarding multi processors and multi computers.

UNIT - I

Parallel Computer Models – System attributes to performance, Multiprocessors and Multicomputers, Classifications of Architectures, Multivector and SIMD Computers, Architecture development tracks

UNIT - II

Program and Network Properties- Conditions for parallelism, Program partitioning and Scheduling, Program flow mechanisms, System interconnect architectures, Performance metrics and measures, Parallel Processing Applications

UNIT-III

Processors and Memory Hierarchy- Advanced Processor Technology, Superscalar and Vector processors, Memory hierarchy technology, Virtual Memory, Backplane bus systems, Cache memory organizations, Shared memory organizations

UNIT - IV

Pipelining and Superscalar Techniques Linear Pipeline processors, Nonlinear pipeline processors, Instruction pipeline design, Arithmetic pipeline design, Superscalar and Super Pipeline Design

UNIT- V

Multiprocessors and Multicomputers Multiprocessor System Interconnects, Cache Coherence and Synchronization mechanisms, Three generations of Multicomputers, Message passing mechanisms, Vector Processing principles, Principles of Multithreading

TEXT BOOKS:

1. Hwang kai, "Advanced Computer Architecture", McGraw-Hill, 2001.
2. Patterson**,** Morgn Kaufmann, "Computer Architecture",2001.

REFERENCE BOOKS:

1. William Stallings, Computer Organization and Architecture, 8th Edition, Prentice-Hall India, 2010.
2. David A Patterson and John L. Hennesey, Computer Organization and Design, 4th Edition, Elsevier India, 2011.
3. Andrew S Tanenbaum and James R Goodman, Structured Computer Organization, 5th Edition PrenticeHall India, 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(17D57105) CAD FOR VLSI
Elective-I

Course Outcomes:

After completion of the course the students will be able to

- Establish comprehensive understanding of the various phases of CAD for digital electronic systems, from digital logic simulation to physical design, including test and verification.
- Demonstrate knowledge and understanding of fundamental concepts in CAD and to establish capability for CAD tool development and enhancement.
- Practice the application of fundamentals of VLSI technologies
- Optimize the implemented design for area, timing and power by applying suitable constraints.
- Gain knowledge on the methodologies involved in design, verification and implementation of digital designs on reconfigurable hardware platform (FPGA)
- Gain knowledge on the methodologies involved in design, verification and implementation of digital designs on MCMs.
- Develop various algorithms at various levels of physical design.

UNIT-I

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.

UNIT-II

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. Placement – Problem formulation, Classification of placement algorithms, Partitioning based placement algorithms.

UNIT-III

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.

UNIT-IV

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.

UNIT –V

Chip Input and Output Circuits : ESD Protection, Input Circuits, Output Circuits, Noise in Circuits, On Chip Clock Generation and Distribution, Latch – Up and its prevention.

TEXT BOOKS:

1. Algorithms for VLSI Physical Design Automation by NaveedShervani, 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 by 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 by Sung Kyu Lim, Springer International Edition

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(17D06202) CPLD AND FPGA ARCHITECTURES AND APPLICATIONS
Elective-II

Course Outcomes:

After completion of the course the students will be able to

- Acquire knowledge about various architectures and device technologies of PLD"s
- Comprehend FPGA Architectures
- Analyze System level Design and their application for Combinational and Sequential Circuits
- Get familiar with Anti-Fuse Programmed FPGAs
- Apply knowledge of this subject for various design applications

UNIT-I

Introduction to Programmable Logic Devices Introduction, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Programmable Logic Devices/ Generic Array Logic; Complex Programmable Logic Devices – Architecture of Xilinx Cool Runner XCR3064XL CPLD, CPLD Implementation of a Parallel Adder with Accumulation.

UNIT-II

Field Programmable Gate Arrays Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

UNIT–III

SRAM Programmable FPGAs Introduction, Programming Technology, Device Architecture, The Xilinx XC2000, XC3000 and XC4000 Architectures.

UNIT–IV

Anti-Fuse Programmed FPGAs Introduction, Programming Technology, Device Architecture, TheActel ACT1, ACT2 and ACT3 Architectures.

UNIT–V

Design Applications General Design Issues, Counter Examples, A Fast Video Controller, A Position Tracker for a Robot Manipulator, A Fast DMA Controller, Designing Counters with ACT devices, Designing Adders and Accumulators with the ACT Architecture.

TEXT BOOKS:

1. Field Programmable Gate Array Technology - Stephen M. Trimberger, Springer International Edition.
2. Digital Systems Design - Charles H. Roth Jr, LizyKurian John, Cengage Learning.

REFERENCE BOOKS:

1. Field Programmable Gate Arrays - John V. Oldfield, Richard C. Dorf, Wiley India.
2. Digital Design Using Field Programmable Gate Arrays - Pak K. Chan/SamihaMourad, Pearson Low Price Edition.
3. Digital Systems Design with FPGAs and CPLDs - Ian Grout, Elsevier,Newnes.
4. FPGA based System Design - Wayne Wolf, Prentice Hall Modern Semiconductor Design Series.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(17D55206) ASIC DESIGN
Elective-II

Course Outcomes:
After completion of the course the student will be able to

- Understand different types of ASICs and their libraries.
- Understands about programmable Asics, I/O modules and their interconnects.
- Gets complete knowledge regarding different methods of software ASIC design their simulation, testing and construction of ASICs.

UNIT I
INTRODUCTION TO ASICs:
Types of ASICs, Design Flow, Case Study, Economics of ASICs, ASIC Cell Libraries, Transistors as resistors, Transistor Parasitic Capacitance, Logical Effort, Library Cell Design, Library Architecture, Gate-Array Design, Standard Cell Design, Data Path Cell Design.

UNIT II
PROGRAMABLE ASICS AND PROGRAMABLE ASIC LOGIC CELLS:
The Anti fuse, Static Ram, EPROM and EEPROM Technology, Practical Issues, Specifications, PREDP Benchmarks, FPGA Economics, Actel ACT, Xilinx LCA, Altera Flex, Altera Max.

UNIT-III
I/O CELLS AND INTERCONNECTS & PROGRAMMABLE ASIC DESIGN SOFTWARE:
DC Output, AC Output, DC input, AC input, Clock input, Power input, Xilinx I/O block, Other I/O Cells, Actel ACT, Xilinx LCA, Xilinx EPLD, Altera Max 5000 and 7000, Altera Max 9000, Altera FLEX, Design Systems, Logic Synthesis, The Half gate ASIC.

UNIT IV
LOW LEVEL DESIGN ENTRY AND LOGIC SYNTHESIS:
Schematic Entry, Low level Design Languages, PLA Tools, EDIF, A logic synthesis example, A Comparator/MUX, Inside a Logic Synthesizer, Synthesis of Viterbi Decoder, Verilog and Logic synthesis, VHDL and Logic Synthesis, Finite State Machine Synthesis, Memory Senthesis, The Engine Controller, Performance Driven Synthesis, Optimization of the viterbi decoder.

UNIT V
SIMULATION, TEST AND ASIC CONSTRUCTION:
Types of Simulation, The Comparator/MUX Example, Logic Systems, How Logic Simulation Works, Cell Models, Delay Models, Static Timing Analysis, Formal Verification, Switch Level Simulation, Transistor Level Simulation, The importance of test, Boundary Scan Test, Faults, Faults Simulation, Automatic Test Pattern Generator, Scan Test, Built in Self Test, A simple test Example, Physical Design, CAD Tools, System Partitioning, Estimating ASIC Size, Power Dissipation, FPGA Partitioning, Partitioning Methods

TEXT BOOKS:
1. Michael John Sebastian Smith, "Application Specific Integrated Circuits", Pearson Education, 2003.
2. L.J.Herbst, "Intigrated Circuit Engineering", Oxford Science Publications, 1996.

REFERENCE BOOKS:
3. HimanshuBhatnagar, "Advanced ASIC Chip Synthesis using Synopsis Design compiler", 2nd Edition, Kluwer Academic, 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(17D57106) OPTIMIZATION TECHNIQUES IN VLSI DESIGN
Elective-II

Course Outcomes:

After completion of the course the students will be able to

- Understand basics of statistical modeling
- Analyze performance of CMOS circuits with respect to power, area and speed
- Gets complete knowledge regarding the various algorithms used for optimization of power and area.

UNIT-I

Statistical Modeling: Modeling sources of variations, Monte Carlo techniques, Process variation modeling- Pelgrom's model, Principle component based modeling, Quad tree based modeling, Performance modeling- Response surface methodology, delay modeling, interconnect delay models.

UNIT-II

Statistical Performance, Power and Yield Analysis Statistical timing analysis, parameter space techniques, Bayesian networks Leakage models, High level statistical analysis, Gate level statistical analysis, dynamic power, leakage power, temperature and power supply variations, High level yield estimation and gate level yield estimation.

UNIT-III

Convex Optimization Convex sets, convex functions, geometric programming, trade-off and sensitivity analysis, Generalized geometric programming, geometric programming applied to digital circuit gate sizing, Floor planning, wire sizing, Approximation and fitting- Monomial fitting, Maxmonomial fitting, Polynomial fitting.

UNIT-IV

Genetic Algorithm Introduction, GA Technology-Steady State Algorithm-Fitness Scaling-Inversion GA for VLSI Design, Layout and Test automation- partitioning-automatic placement, routing technology, Mapping for FPGA- Automatic test generation- Partitioning algorithm Taxonomy-Multi-way Partitioning Hybrid genetic-encoding-local improvement-WDFR Comparison of CAS-Standard cell placement GASP algorithm-unified algorithm.

UNIT-V

GA Routing Procedures and Power Estimation Global routing-FPGA technology mapping-circuit generation-test generation in a GA frame work-test generation procedures, Power estimation-application of GA Standard cell placement-GA for ATG-problem encoding- fitness function-GA Vs Conventional algorithm.

TEXT BOOKS:

1. Statistical Analysis and Optimization for VLSI: Timing and Power -AshishSrivastava, Dennis Sylvester, David Blaauw, Springer, 2005.

2. Genetic Algorithm for VLSI Design, Layout and Test Automation -PinakiMazumder, E.Mrudnick, Prentice Hall,1998.

REFERENCE BOOKS:

1. Convex Optimization - Stephen Boyd, LievenVandenberghe, Cambridge University Press,2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

(17D38107) STRUCTURAL DIGITAL SYSTEM DESIGN LAB

Course Objective:

- To understand about VHDL and Verilog Programming in all available styles.
- To understand differences between Verilog and VHDL.
- To represent the different digital blocks in verilog and VHDL in all available styles of modelling

Course Outcome:

After completion of this course the students will be able to understand

- Different modeling styles available in VHDL and Verilog and difference between them
- Difference between verilog and VHDL
- Representation of different digital modules in different modelling styles available in VHDL and Verilog

Using VHDL or Verilog do the following experiments

1. Design of 4-bit adder / subtractor
2. Design of Booth Multiplier
3. Design of 4-bit ALU
4. Design SISO, SIPO, PISO, PIPO Registers
5. Design of Ripple, Johnson and Ring counters
6. Design of MIPS processor
7. Design of Washing machine controller
8. Design of Traffic Light Controller
9. Design “1010” pattern detector using Mealy state Machine
10. Design “1100” recursive pattern detector using Moore state Machine
11. Design simple Security System Using FSM/ASM
12. Mini Project

Tools Required:

VHDL or VERILOG

Hardware Required:

Computers with latest Configuration.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year I Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

(17D57107) VLSI SYSTEM DESIGN LAB - I

Learning Outcomes:

After completion of this course the students will be able to

- Understand syntax of various commands available with verilog and fundamental associated with design of digital systems
- To design and simulate and implement various digital system like traffic light controller, UART.
- Able develop problem solving skills and adapt them to solve real world problems
- Write scripts using perl for building digital blocks

The students are required to design the logic circuit to perform the following experiments using necessary simulator (Xilinx ISE Simulator/Mentor Graphics Questa Simulator) to verify the logical /functional operation and to perform the analysis with appropriate synthesizer (Xilinx ISE Synthesizer/Mentor Graphics Precision RTL) and then verify the implemented logic with different hardware modules/kits (CPLD/FPGA kits).

The students are required to design and implement the Layout of the following experiments of any SIX using CMOS 130nm Technology.

List of Experiments:

1. Inverter Characteristics.
2. Full Adder.
3. RS-Latch, D-Latch and Clock Divider.
4. Synchronous Counter and Asynchronous Counter.
5. Static RAM Cell.
6. Dynamic RAM Cell.
7. ROM
8. Digital-to-Analog-Converter.
9. Analog-to-Digital Converter.
10. “10101” pattern detector using Mealy FSM
11. Analytical Comparator.
12. Mini Project

Lab Requirements:

Software:

Xilinx ISE Suite, Mentor Graphics-Questa Simulator, Mentor Graphics-Precision RTL, Perl Software.

Hardware:

Personal Computer with necessary peripherals, configuration and operating System and relevant VLSI (CPLD/FPGA) hardware Kits.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D57201) LOW POWER VLSI DESIGN

Course Outcomes:

After completion of this subject, students will be able to

- Understand the concepts of velocity saturation, Impact Ionization and Hot Electron Effect
- Implement Low power design approaches for system level and circuit level measures.
- Design low power adders, multipliers and memories for efficient design of systems.

UNIT –I:

Fundamentals:

Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT –II:

Low-Power Design Approaches:

Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

UNIT –III:

Low-Voltage Low-Power Adders:

Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques – Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

UNIT –IV:

Low-Voltage Low-Power Multipliers:

Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

UNIT –V:

Low-Voltage Low-Power Memories:

Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

TEXT BOOKS:

1.CMOS Digital Integrated Circuits – Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 2011.

2. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011.
2. Low Power CMOS Design – AnanthaChandrakasan, IEEE Press/Wiley International, 1998.
3. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons, 2000.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D57202) CMOS MIXED SIGNAL DESIGN

Course outcomes:

After the Completion of the course the students will be able to

- Demonstrate first order filter with least interference
- Extend the concept of phase locked loop for designing PLL application with minimum jitter by considering non ideal effects.
- Design different A/D, D/A, modulators, demodulators and different filter for real time applications

UNIT-I

Switched Capacitor Circuits Introduction to Switched Capacitor circuits- basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, biquad filters.

UNIT-II

Phased Lock Loop (PLL) Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs-Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs- PFD/CP non-idealities, Jitter in PLLs, Delay locked loops, applications.

UNIT-III

Data Converter Fundamentals DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

UNIT-IV

Nyquist Rate A/D Converters Successive approximation converters, Flash converter, Two-step A/D converters, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time-interleaved converters.

UNIT-V

Oversampling Converters Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibitquantizers, Delta sigma D/A

TEXT BOOKS:

1. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition, 2002
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
3. Analog Integrated Circuit Design- David A. Johns,Ken Martin, Wiley Student Edition, 2013

REFERENCE BOOKS:

1. CMOS Integrated Analog-to- Digital and Digital-to-Analog converters- Rudy Van De Plassche, Kluwer Academic Publishers, 2003
2. Understanding Delta-Sigma Data converters-Richard Schreier, Wiley Interscience, 2005.
3. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Interscience,2009

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D06201) EMBEDDED SYSTEM DESIGN

Course Outcomes:

After completion of this course the students will be able to understand

- The issues relating to hardware and software design concepts associated with processor in Embedded Systems.
- The concept of low power microcontrollers.
- The hardware software co- design issues pertaining to design of an Embedded System using low power microcontrollers.

UNIT – I

Introductionto Embedded Electronic Systems and Microcontrollers:

An Embedded System-Definition, Embedded System Design and Development Life Cycle, An Introduction to Embedded system Architecture, The Embedded Systems Model, Embedded Hardware:The Embedded Board and the von Neumann Model, Embedded Processors: ISAArchitectureModels, Internal Processor Design, Processor Performance, Board Memory: Read-Only Memory (ROM), Random-Access Memory (RAM), Auxiliary Memory, Memory Management of External Memory and Performance, Approaches to Embedded Systems, Small Microcontrollers, Anatomy of a Typical Small Microcontroller, Small Microcontrollers Memory, Embedded Software, Introduction to small microcontroller (MSP430).

UNIT-II

MSP430 – I:

Architecture of the MSP430 Processor: Central Processing Unit, Addressing Modes, Constant Generator and Emulated Instructions, Instruction Set, Examples, Reflections on the CPU and Instruction Set, Resets, Clock System, Memory and Memory Organization.

Functions, Interrupts, and Low-Power Mode: Functions and Subroutines, Storage for Local Variables, Passing Parameters to a Subroutine and Returning a Result, Mixing C and Assembly Language, Interrupts, Interrupt Service Routines, Issues Associated with Interrupts, Low-Power Modes of Operation.

UNIT – III

MSP430 – II:

Digital Input, Output, and Displays: Parallel Ports, Digital Inputs, Switch Debounce, Digital Outputs, Interface between Systems, Driving Heavier Loads, Liquid Crystal Displays, Simple Applications of the LCD.

Timers: Watchdog Timer, Timer_A, Timer_A Modes, Timer_B,Timer_B Modes, Setting the Real-Time Clock, State Machines.

UNIT – IV

MSP430 Communication:

Communication Peripherals in the MSP430, Serial Peripheral Interface, SPI with the USI, SPI with the USCI, AThermometer Using SPI Modes,Inter-integrated Circuit Bus(I^2C) and its operations, State Machines for I^2C Communication, AThermometer Using I^2C, Asynchronous Serial Communication, Asynchronous Communication with the USCI_A, ASoftware UART Using Timer_A, Other Types of Communication.

UNIT – V

MSP430 Case Studies:

Introduction to Code Composer studio (CC Studio Ver. 6.1) a tutorial, A Study of blinking LED, Enabling LED using Switches, UART Communication, LCD interfacing, Interrupts, Analog to Digital Conversion, General Purpose input and output ports, I2C.

TEXT BOOKS:

1. Tammy Noergaard “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”, Elsevier(Singapore) Pvt.Ltd.Publications, 2005.
2. John H. Davies “MSP430 Microcontroller Basics”,Elsevier Ltd Publications, Copyright 2008.

REFERENCE BOOKS

1. Manuel Jiménez Rogelio,PalomeraIsidoroCouvertier “Introduction to Embedded SystemsUsing Microcontrollers and the MSP430” Springer Publications, 2014.
2. Frank Vahid, Tony D. Givargis, “Embedded system Design: A Unified Hardware/Software Introduction”, John Wily & Sons Inc.2002.
3. Peter Marwedel, “Embedded System Design”, Science Publishers, 2007.
4. Arnold S Burger, “Embedded System Design”, CMP Books, 2002.
5. Rajkamal, “Embedded Systems: Architecture, Programming and Design”, TMH Publications,Second Edition, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
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(17D06109) TEST AND TESTABILITY

Course Outcomes:

After completion of this course the students will be able to

- Understand different types of faults associated with logic circuits and types of testing by employing fault models to the logic circuits.
- Study about different methods of simulation and algorithms associated with testing.
- Get complete knowledge about different methods of simulation and algorithms associated with testing.

UNIT-I: 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.

UNIT-II: Logic and Fault Simulation

Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-value Simulation, Algorithms for Fault Simulation.

UNIT -III: 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.

UNIT-IV: 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.

UNIT-V: 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.

TEXT BOOKS:

1. M.L. Bushnell, V. D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits", Kluwer Academic Pulishers.
2. M. Abramovici, M.A.Breuer and A.D Friedman, "Digital Systems and Testable Design", Jaico Publishing House.

REFERENCE BOOKS:

3. P.K. Lala, "Digital Circuits Testing and Testability", Academic Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
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(17D55201) SYSTEM ON CHIP ARCHITECTURE

Elective-III

Course Outcomes:

After completion of this course the students will be able to

- Get complete basics related to SoC architecture and different approaches related to SoC Design.
- Able to select an appropriated robust processor for SoC Design
- Able to Select an appropriate memory for SoC Design.
- Design SoC
- Realize real time case studies

UNIT I:

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT II:

Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT III:

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation , SOC Memory System, Models of Simple Processor – memory interaction.

UNIT IV:

Interconnect Customization and Configuration: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses , Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT V:

Application Studies / Case Studies: SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

TEXT BOOKS:

1. Computer System Design System-on-Chip - Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd.
2. ARM System on Chip Architecture – Steve Furber –2nd Ed., 2000, Addison Wesley Professional.

REFERENCE BOOKS:

1. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer
2. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM.
3. System on Chip Verification – Methodologies and Techniques –PrakashRashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
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(17D57203) SEMICONDUCTOR MEMORY DESIGN AND TESTING

Elective-III

Course Outcomes:

After completion of the course the students will be able to

- Get complete knowledge regarding different types of memories, their architectural and different packing techniques of memories.
- Able to build fault models for memory testing.
- Analyze different parameters that leads malfunctioning of memories.
- Design reliable memories with efficient architecture to improve processes times and power

UNIT-I Random Access Memory Technologies SRAM – SRAM Cell structures, MOS SRAM Architecture, MOS SRAM cell and peripheral circuit operation, Bipolar SRAM technologies, SOI technology, Advanced SRAM architectures and technologies, Application specific SRAMs, DRAM – DRAM technology development, CMOS DRAM, DRAM cell theory and advanced cell structures, BICMOS DRAM, soft error failure in DRAM, Advanced DRAM design and architecture, Application specific DRAM.

UNIT-II Non-volatile Memories Masked ROMs, High density ROM, PROM, Bipolar ROM, CMOS PROMS, EPROM, Floating gate EPROM cell, One time programmable EPROM, EEPROM, EEPROM technology and architecture, Non-volatile SRAM, Flash Memories (EPROM or EEPROM), advanced Flash memory architecture

UNIT-III Memory Fault Modeling Testing and Memory Design for Testability and Fault Tolerance RAM fault modeling, Electrical testing, Pseudo Random testing, Megabit DRAM Testing, non-volatile memory modeling and testing, IDDQ fault modeling and testing, Application specific memory testing, RAM fault modeling, BIST techniques for memory

UNIT-IV Semiconductor Memory Reliability and Radiation Effects General reliability issues RAM failure modes and mechanism, Non-volatile memory reliability, reliability modeling and failure rate prediction, Design for Reliability, Reliability Test Structures, Reliability Screening and qualification, Radiation effects, Single Event Phenomenon (SEP), Radiation Hardening techniques, Radiation Hardening Process and Design Issues, Radiation Hardened Memory characteristics, Radiation Hardness Assurance and Testing, Radiation Dosimetry, Water Level Radiation Testing and Test structures

UNIT-V Advanced Memory Technologies and High-density Memory Packing Technologies Ferroelectric RAMs (FRAMs), GaAs FRAMs, Analog memories, magneto resistive RAMs (MRAMs), Experimental memory devices, Memory Hybrids and MCMs (2D), Memory Stacks and MCMs (3D), Memory MCM testing and reliability issues, Memory cards, High Density Memory Packaging Future Directions.

TEXT BOOKS:

1. Semiconductor Memories Technology – Ashok K. Sharma, 2002, Wiley.

2. Advanced Semiconductor Memories – Architecture, Design and Applications - Ashok K. Sharma-2002, Wiley.

REFERENCE BOOKS:

1. Modern Semiconductor Devices for Integrated Circuits – Chenming C Hu, 1st Ed., Prentice all.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
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(17D57204) RF IC DESIGN

Course outcomes:

After completion of the course the students will be able to

- Demonstrate in-depth knowledge in Radio Frequency Integrated Circuits.
- Analyze complex engineering problems critically for conducting research in RF systems.
- Solve engineering problems with wide range of solutions in Radio Frequency Integrated circuits.
- Apply appropriate techniques to engineering activities in the field of RFIC Design.

UNIT – I: BASIC CONCEPTS IN RF DESIGN

Introduction to RF Design, Units in RF design, Time Variance and Nonlinearity, Effects of nonlinearity, random processes and Noise, Definitions of sensitivity and dynamic range, Passive impedance transformation, Scattering parameters.

UNIT – II: TRANSCEIVER ARCHITECTURES

General considerations, Receiver Architectures-Basic Heterodyne receivers, Modern heterodyne receivers, Direct conversion receivers, Image-Reject receivers, Low-IF receivers. Transmitter Architectures-Direct Conversion transmitters, Modern direct conversion Transmitters, Heterodyne Transmitters, Other Transmitter Architectures.

UNIT -III: LNA AND MIXERS

General considerations, Problem of input matching, Low Noise Amplifiers design in various topologies, Gain Switching, Band Switching, Mixers-General considerations, Passive down conversion mixers, Active down conversion mixers, Up conversion mixers.

UNIT – IV: OSCILLATORS

Performance parameters, Basic principles, Cross coupled oscillator, Three point oscillators, Voltage Controlled Oscillators, LC VCOs with wide tuning range, phase noise, Mathematical model of VCOS, Quadrature Oscillators.

UNIT – V: PLL AND POWER AMPLIFIER

PLLS-Phase detector, Type-I PLLs, Type-II PLLs, PFD/CP Nonidealities, Phase noise in PLLs, Loop Bandwidth. Power Amplifiers-General considerations, Classification of power amplifiers, High-Efficiency power amplifiers, Cascode output stages, Large signal impedance matching, Linearization techniques.

TEXT BOOKS:

1. B.Razavi, “RF Microelectronics”, Prentice-Hall PTR, 2nd Edition, 1998.

REFERENCE BOOKS:

1. T.H.Lee, “The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2nd, 1998.
2. R.Jacob Baker, Harry W.Li, D.E. Boyce, “CMOS Circuit Design, Layout and Simulation”, Prentice-Hall of India, 1998.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(17D38202) INTERNET OF THINGS
Elective-IV

Course Outcomes:
After completion of the course the student will be able to

- Able to understand the application areas of IOT
- Able to realize the revolution of Internet in Mobile Devices, Cloud &Sensor Networks
- Able to understand building blocks of Internet of Things and characteristics.

Unit I
Introduction & Concepts: Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels.

Unit II
Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

Unit III
M2M & System Management with NETCONF-YANG: M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG.

Unit IV
Developing Internet of Things & Logical Design using Python: Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/ Time Operations, Classes, Python Packages.

Unit V
IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device, Board, Linux on Raspberry Pi, Interfaces, and Programming& IOT Devices.

TEXT BOOKS:
1. VijayMadisetti, ArshdeepBahga," Internet of ThingsA Hands-On- Approach",2014, ISBN:978 0996025515

REFERENCE BOOKS:
1. AdrianMcEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN:978-1-118-43062-0
2. Daniel Kellmereit, "The Silent Intelligence: The Internet of Things". 2013, ISBN0989973700

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(17D55204) HARDWARE AND SOFTWARE CO-DESIGN OF EMBEDDED SYSTEM
Elective-IV

Course outcomes:
After completion of this course the students will be able to

- Analyze and apply design methodologies.
- Appreciate the fundamental building blocks of the using hardware and software co-design and related implementation and testing environments and techniques and their interrelationships.
- Get familiar with modern hardware/software tools for building prototypes and to be able to demonstrate practical competence in these areas

UNIT I NATURE OF HARDWARE AND SOFTWARE
Hardware, Software, Definition of Hardware/Software Co-Design – Driving factors Platform design space – Application mapping – Dualism of Hardware design and software design – Concurrency and parallelism, Data flow modeling and Transformation – Data Flow Graph – Tokens, actors and queues, Firing rates, firing rules and Schedules – Synchronous data flow graph – control flow modeling – Adding time and resources – Transformations.

UNIT II DATA FLOW IMPLEMENTATION IN SOFTWARE AND HARDWARE
Software Implementation of Data Flow – Converting queues and actors into software, Dynamic Scheduler – Hardware Implementation of Data Flow – single rate SDF graphs into hardware, Pipelining – Analysis of control flow and data flow – construction of control and data flow graph – Translating C into hardware – Designing data path and controller.

UNIT III DESIGN SPACE OF CUSTOM ARCHITECTURES
Finite state machines with datapath – FSMD design example, Limitations – Microprogrammed Architecture – Microprogrammed control, microinstruction encoding, Microprogrammed data path, microprogrammed machine – General purpose Embedded Core – RISC pipeline, Program organization – SoC interfaces for custom hardware – Design Principles in SoC Architecture

UNIT IV HARDWARE/ SOFTWARE INTERFACES
Principles of Hardware/software communication – synchronization schemes, communication constrained versus Computation constrained, Tight and Loose coupling - On-chip buses – Memory mapped interfaces – coprocessor interfaces – custom instruction interfaces – Coprocessor hardware interface – Data and control design, programmer‟s model.

UNIT V CASE STUDIES TriviumCripto coprocessor – Trivium stream cipher algorithm, Trivium for 8-bit platforms – AES coprocessor, CORDIC coprocessor – algorithm and implementation.

1. Ralf Niemann, “Hardware/Software Co-Design for Data Flow Dominated Embedded Systems”, Kluwer Academic Pub, 1998.
2. Jorgen Staunstrup, Wayne Wolf, ”Hardware/Software Co-Design: Principles and Practice” , Kluwer Academic Pub, 1997.

REFERENCE BOOKS:

1. Giovanni De Micheli, Rolf Ernst Morgon, ”Reading in Hardware/Software Co-Design“ Kaufmann Publishers, 2001.
2. Patrick Schaumont, A Practical Introduction to Hardware/Software Codesign, 2nd Edition, Springer, 2010.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

(17D57205) PHYSICAL DESIGN AUTOMATION

Elective-IV

Course Outcomes:

After completion of the course the students will be able to

- Understand relation between automation algorithms and constraints posed by VLSI technology.
- Adopt algorithms to meet critical design parameters.
- Design area efficient logics by employing different routing algorithms and shape functions
- Simulate and synthesis different combinational and sequential logics

UNIT-I

VLSI design automation tools: algorithms and system design. Structural and logic design. Transistor level design.Layout design.Verification methods. Design management tools.

UNIT-II

Layout compaction, placement and routing, Design rules, symbolic layout. Applications of compaction.Formulation methods.Algorithms for constrained graph compaction.Circuit representation. Wire length estimation. Placement algorithms.Partitioning algorithms.

UNIT-III

Floor planning and routing: floor planning concepts. Shape functions and floor planning sizing. Local routing.Area routing.Channel routing, global routing and its algorithms.

UNIT-IV

Simulation and logic synthesis: gate level and switch level modeling and simulation. Introduction to combinational logic synthesis.ROBDD principles, implementation, construction and manipulation. Two level logic synthesis.

UNIT-V

High-level synthesis: hardware model for high level synthesis. Internal representation of input algorithms. Allocation, assignment and scheduling. Scheduling algorithms. Aspects of assignment. High level transformations.

TEXT BOOKS:

1. S.H. Gerez, Algorithms for VLSI Design Automation, John Wiley ,1998.
2. N.A.Sherwani , Algorithms for VLSI Physical Design Automation, (3/e), Kluwer,1999.

REFERENCE BOOKS:

1. S.M. Sait , H. Youssef, VLSI Physical Design Automation, World scientific, 1999.
2. M.Sarrafzadeh, Introduction to VLSI Physical Design, McGraw Hill (IE), 1996

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
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(17D38208) EMBEDDED SYSTEM DESIGN LAB

Course Outcomes:

After Completion of this Lab, Students will be able to

- Design and Implement basic circuits that are used in Embedded systems.
- Develop code using appropriate tools.
- Test the circuit performance with standard benchmark circuits.

List of Experiments

PART – A

Using Embedded C

Note: Any 10 Programs form the following

1. Write a simple program to print "hello world"
2. Write a simple program to show a delay.
3. Write a loop application to copy values from P1 to P2
4. Write a c program for counting the no of times that a switch is pressed & released.
5. Illustrate the use of port header file (port M) using an interface consisting of a keypad and liquid crystal display.
6. Write a program to create a portable hardward delay.
7. Write a c program to test loop time outs.
8. Write a c program to test hardware based timeout loops.
9. Develop a simple EOS showing traffic light sequencing.
10. Write a program to display elapsed time over RS-232 link.
11. Write a program to drive SEOS using Timer 0.
12. Develop software for milk pasteurization system.

PART – B

Note. Any 6 Programs from the following (Experiment – 1 is mandatory)

1. A Study of Code Composer Studio (CC Studio Latest Version)
2. Flashing a light by a software delay.
3. Displaying Characters on LCD.
4. Serial Communication using UART.
5. Basic Input and Output using MSP430 UART.
6. Interrupt Handling using MSP430.
7. Analog to Digital Conversion using MSP430.
8. Interfacing external Devices to GPIO Ports

Equipments Required:

1. Computers with latest configuration.
2. Code Composer Studio v6.1 (Preferably Latest version)
3. MSP430/ARM based Hardware kits and add-on boards.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I year II Semester (VLSI SYSTEM DESIGN)	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

(17D57206) VLSI SYSTEM DESIGN LAB - II

Course Outcomes:

The students are required to perform any Six of the following experimental concepts with suitable complexity mixed-signal application based circuits o (circuits consisting of both analog and digital parts) using necessary software tools.

List of experimental Concepts:

1. Analog circuit simulation.
2. Digital circuit simulation.
3. Mixed signal simulation.
4. Layout Extraction.
5. Parasitic values estimation from layout
6. Layout Vs Schematic.
7. Net List Extraction.
8. Design Rule Checks.

Lab Requirements:

Software: Xilinx ISE Suite 13.2 Version, Mentor Graphics-Questa Simulator, Mentor Graphics-Precision RTL, Mentor Graphics Back End/Tanner Software tool, Mixed Signal simulator

Hardware: Personal Computer with necessary peripherals, configuration and operating System and relevant VLSI (CPLD/FPGA) hardware Kits.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech III semester (VLSI SYSTEM DESIGN) **L T P C**

4 0 0 4

(17D20301) RESEARCH METHODOLOGY
(Elective V-OPEN ELECTIVE)

UNIT I

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.

UNIT II

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.

UNIT III

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

UNIT IV

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 – Multi-variate Analysis.

UNIT V

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.

Text Books:

Research Methodology:Methods And Techniques – C.R.Kothari, 2nd Edition,New Age International Publishers.
Research Methodology: A Step By Step Guide For Beginners- Ranjit Kumar, Sage Publications (Available As Pdf On Internet)
Research Methodology And Statistical Tools – P.Narayana Reddy And G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.

REFERENCES:

1. Scientists Must Write - Robert Barrass (Available As Pdf On Internet)
2. Crafting Your Research Future –Charles X. Ling And Quiang Yang (Available As Pdf On Internet)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech III semester (VLSI SYSTEM DESIGN) **L T P C**

4 0 0 4

(17D20302) HUMAN VALUES AND PROFESSIONAL ETHICS

(Elective V-OPEN ELECTIVE)

Unit I:

HUMAN VALUES:Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Spirituality.

Unit II:

ENGINEERING ETHICS: Senses of Engineering Ethics- Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg‟s theory- Gilligan‟s theory- Consensus and controversy – Models of professional roles- Theories about right action- Self interest - Customs and religion –Uses of Ethical theories – Valuing time –Co operation – Commitment.

Unit III :

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

UNIT IV:

ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK: Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing riskSafety and the Engineer- Designing for the safety- Intellectual Property rights(IPR).

UINIT V:

GLOBAL ISSUES: Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics .

Text Books :

1. “Engineering Ethics includes Human Values” by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
2. “Engineering Ethics” by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
3. “Ethics in Engineering” by Mike W. Martin and Roland Schinzinger – Tata McGrawHill– 2003.
4. “Professional Ethics and Morals” by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
5. “Professional Ethics and Human Values” by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran , Laxmi Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech III semester (VLSI SYSTEM DESIGN) **L T P C**

4 0 0 4

(17D20303) INTELLECTUAL PROPERTY RIGHTS
(Elective V-OPEN ELECTIVE)

UNIT – I

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.

Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.

Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V

New Development Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.

International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

TEXT BOOKS & REFERENCES:

1. Intellectual Property Right, Deborah. E. Bouchoux, Cengage Learing.
2. Intellectual Property Right – Nleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,