MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE STRUCTURE

M.TECH (MACHINE DESIGN)

I Year I Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C
1	R22D1501	Advanced Mechanical Engineering Design	3	-	3
2	R22D1502	Mechanical Behaviour of Materials	3	-	3
3	R22D1503 R22D1504 R22D1505	1. Advanced Finite Element Analysis 2. Analysis of Gear Engineering 3. Theory of Elasticity & Plasticity	3	-	3
4	R22D1506 R22D1507 R22D1508	1. Advanced Mechanics of Composite Materials 2. Advanced Computer-Aided Design 3. Applied Tribology	3	-	3
5	R22D1581	Kinematics and Dynamics Lab	-	4	2
6	R22D1582	Advanced Computer-Aided Modelling Lab		4	2
7	R22DHS53	Research Methodology & IPR	2		2
8	R22DHS54*	Value Education	2	-	0
Total			16	8	18

***Audit course: Non-credit course, 50% of the scoring is required for the award of the degree**

I Year II Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C
1	R22D1509	Advanced Mechanics of Machinery	3	-	3
2	R22D1510	Experimental Stress Analysis	3	-	3
3	R22D1511 R22D1512 R22D1513	1. Industrial Robotics 2. Design of Hydraulic and Pneumatic Systems 3. Mechatronics	3	-	3
4	R22D1514 R22D2112 R22D1515	1. Computer Integrated Manufacturing 2. Computational Fluid Dynamics 3. Advanced Mechanical Vibrations	3	-	3
5	R22D1583	Advanced Computer-Aided Analysis Lab	-	4	2
6	R22D1584	Computational Dynamics Lab		4	2
7	R22D1591	Mini Project	2		2
8	R22DHS55*	English for Research Paper Writing	2	-	0
Total			16	8	18

***Audit course: Non-credit course, 50% of the scoring is required for the award of the degree**

II Year I Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C
1	R22D1516 R22D1517 R22D1518	1. Design for the Internet of Things 2. Design for Manufacture Assembly and Environment 3. MEMS: Design Fabrication and Characterization	3	-	3
2		OPEN ELECTIVE	3	-	3
3	R22D1585	Dissertation Phase-I	-	12	6
Total			6	12	12

OPEN ELECTIVE	
Subject Code	Subject Name
R22DME51	Non-Conventional Energy Sources
R22DME52	Industrial Safety
R22DME53	Operations Research
R22DHS51	Business Analytics
R22DCS51	Scripting Languages
R22DAE51	Mathematical Modeling Techniques
R22DEC51	Embedded Systems Programming

II Year II Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C
1	R22D1586	Dissertation Phase-II	-	12	6
2	R22D1587	Dissertation Project Viva Voce	-	28	14
Total			-	40	20

I YEAR
I SEMESTER

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**
3/-/3

(R22D1501) ADVANCED MECHANICAL ENGINEERING DESIGN

INTRODUCTION:

Course Objectives:

- Understanding the motion of the component and the basic geometry of the mechanisms.
- Understanding the process and methods of design of machines and elements.
- The kinematics of machines deals with the motion of members of the mechanisms which includes the determination of velocities and acceleration of the machine members.
- Abilities to develop equations pertaining to the design of machines.
- Ability to design new machines or modify existing machines according to the need.

UNIT-I

Design Philosophy: Design process, Problem formation, Introduction to product design, various design models-Shigley model, Asimov model, and Norton model, Need analysis, Strength considerations -standardization. Creativity, Creative techniques, Material selections, Notches and stress concentration, and design for safety and Reliability.

UNIT-II

Product Design: Product strategies, value, planning, and specification, concept generation, concept selection, and concept testing.

Design for manufacturing: Forging design, Casting design, and Design process nonmetallic parts, Plastics, Rubber, Ceramic, Wood and, Glass parts. Material selection in machine design.

UNIT-III

Failure Theories: Static failure theories, Distortion energy theory, Maximum shear stress theory, Coulomb-Mohr's theory, Modified Mohr's theory, Fracture mechanics theory, Fatigue mechanisms, Fatigue failure models, Design for fatigue strength and life, creep: Types of stress variation, design for fluctuating stresses, design for limited cycles, multiple stress cycles, Fatigue failure theories, cumulative fatigue damage, thermal fatigue and shock, harmful and beneficial residual stresses, Yielding and transformation.

UNIT-IV

Surface Failures: Surface geometry, mating surfaces, oil film and their effects, design values and procedures, adhesive wear, abrasive wear, corrosion wear, surface fatigue, different contacts, dynamic contact stresses, surface fatigue failures, surface fatigue strength.

UNIT-V

Economic Factors Influencing Design: Economic analysis, Break-even analysis, Human engineering considerations, Ergonomics, Design of controls, Design of displays. Value engineering, Material and process selection in value engineering, Modern approaches in design.

TEXT BOOKS:

1 Machine Design An Integrated Approach / Robert L. Norton / Prentice-Hall New . Jersey, USA.

2 Engineering Design / George E Dieter / McGraw Hill /2008

3 Mechanical Engineering Design / J.E. Shigley and L.D. Mitchell / McGraw Hill . International Book Company, New Delhi.

REFERENCE BOOKS:

1 Fundamentals of machine elements/ Hamrock, Schmid and Jacobian/ 2nd edition /McGraw-Hill International edition.

2 Product design and development / Karl T. Ulrich and Steven D. Eppinger / 3rd edition/ Tata McGraw Hill.

3 Product Design and Manufacturing /A.K. Chitale and R.C. Gupta / Prentice Hall

Course Outcomes:

After Completion of this course students will be able to

- Apply the knowledge of Mathematics, Science and Engineering for designing machine part. Propose the Engineering solutions for global progress, productivity and economic development. List the materials and variety of mechanical components available/used to produce every day goods and services.
- Identify and solve the engineering challenges regarding the human needs in daily life about machines and systems. List the processes and methods of design of machines and elements. Develop equations and relations pertaining to the design of machines Develop fundamental knowledge of the Standards used in the design of machine elements. List different materials and state their properties
- Design component, machine, workstation and systems etc. for safe working by minimizing accidents and other health hazards. List and define functionality of various parts used in Automobiles, working principles and their design which include brakes, Gears, Clutches, and Springs etc.
- Design new machines or modify the existing machines according to the need, also use the techniques, skills and modern engineering tools for engineering practice. Communicate effectively through written and oral skills.
- Knowledge of different materials and their properties for designing the components of machine elements.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/T/P/C**
3/-/-/3

(R22D1502) MECHANICAL BEHAVIOUR OF MATERIALS

OBJECTIVES:

- To know the mechanical behaviour of both metallic and non-metallic materials under different loading and temperature conditions.
- To provide students with basic understanding of phase transformation by heat treatment.
- To understand stress-induced hardening, linear and nonlinear elastic behavior, deformation under multiaxial loading, plastic deformation and yield criteria, dislocation plasticity.
- To provide basic understanding about the behavior of materials during various loading conditions.
- To know about the strengthening mechanisms, creep, stress concentration effects, brittle versus ductile fracture, fracture mechanisms at different scales, fatigue, contact deformation, and wear.

UNIT I

BASIC CONCEPTS OF MATERIAL BEHAVIOR: Elasticity in metals and polymers – Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fiber, and dispersion strengthening. Effect of temperature, strain, and strain rate on plastic behaviour – Super plasticity – Griffith's theory, – Ductile, brittle transition in steel – High-temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps.

UNIT II

BEHAVIOUR UNDER DYNAMIC LOADS AND DESIGN APPROACHES: Stress intensity factor and fracture toughness – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms, and Paris law. A safe life, Stress-life, strain-life and fail-safe design approaches -Effect of surface and metallurgical parameters on fatigue – Fracture of non-metallic materials – Failure analysis, sources of failure, the procedure of failure analysis.

UNIT III

SELECTION OF MATERIALS: Motivation for selection, cost basis, and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

UNIT IV

MODERN METALLIC MATERIALS: Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

UNIT V

NON-METALLIC MATERIALS

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives, and coating – structure, properties, and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing, and applications.

TEXTBOOKS

1. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988
2. Thomas H. Courtney, Mechanical Behavior of Materials, (2nd edition), McGraw Hill, 2000

REFERENCES

1. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (34d edition), Butterworth-Heiremann, 1997.
2. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.
3. Metals Handbook, Vol.10, Failure Analysis and Prevention, (10th Edition), Jaico, 1999.

Course Outcomes:

- After completing this course, the student should be able to understand the different modes of failures like fracture, fatigue, and creep of ductile and brittle materials.
- To familiarize the researchers in the area of material behaviour under different loading and selection of materials for the design of engineering structures.
- Acquiring the basic level knowledge of Materials Science and Engineering Utilizing state-of-the-art techniques in the area of Materials Science and Engineering
- Defining and solving engineering problems related to material characteristics and properties.
- Students will demonstrate an understanding of the mechanical properties and behavior of materials.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**
3/-/3

(R22D1503) ADVANCED FINITE ELEMENT ANALYSIS

(PROGRAM ELECTIVE–I)

Course Objectives:

- Apply vector mechanics as a tool for problem solving.
- Understand the need in Design for the Finite Element Method.
- Understanding of mechanical engineering design concepts to use the Finite Element Method software correctly and efficiently.
- Analyze a physical problem, develop experimental procedures for accurately investigating the problem, and effectively perform and document findings.
- Understand forces associated with different parts of a machine

UNIT-I

Introduction to FEM, basic concepts, historical background, applications of FEM, general description, comparison of FEM with other methods, variational approach, Glerkin's Methods. Coordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain- displacement relations.

UNIT-II

1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions, and problems. ANALYSIS OF TRUSSES: Plane Trusses and Space Truss elements and problems ANALYSIS OF BEAMS: EFA Hermite shape functions – stiffness matrix – Load vector – Problems.

UNIT-III

2-D Problems: CST, LST, force terms, Stiffness matrix, and load vectors, boundary conditions, Isoparametric elements – quadrilateral element, shape functions – Numerical Integration. Finite element modelling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. 3-D PROBLEMS: Tetrahedran element – Jacobian matrix – Stiffness matrix.

UNIT-IV

Scalar Field Problems: 1-D Heat Conduction-Slabs – fins - 2-D heat conduction problems – Introduction to Torsional problems.

UNIT-V

Dynamic Considerations: Dynamic equations – consistent mass matrix – Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

TEXTBOOKS:

1. The Finite Element Methods in Engineering / SS Rao / Pergamon.
2. Finite Element Methods: Basic Concepts and applications, Alavala, PHI
3. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice – Hall

REFERENCE BOOKS:

1. Finite Element Method – Zienkiewicz / Mc Graw Hill
2. Introduction to Fininte element analysis- S.Md.Jalaludeen,Anuradha Publications, print-2012
3. A First Course in the Finite Element Method/Daryl L Logan/Cengage Learning/5th . Edition

Course Outcomes:

After Completion of this course, students will be able to solve

- Numerical methods involved in Finite Element Theory.
- Definition of truss, beam, membrane, plate, and continuum elements. Formulation of planar one-dimensional (truss and beam) elements having linear, quadratic, and cubic shape functions.
- Global, local, and natural coordinates. Formulation of planar, plane stress two-dimensional elements (rectangular and quadratic quadrilateral elements).
- Formulation of 3-dimensional elements (four-node tetrahedral and eight-node brick elements).
- Direct formulation and basic energy and weighted residual formulation of finite elements. Procedures for performing and verifying FEA using commercial FEA software.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**
3/-/3

(R22D1504) ANALYSIS OF GEAR ENGINEERING
(PROGRAM ELECTIVE–I)
(Design Data Book Permitted)

Course Objectives:

- To develop an ability to design a system, component, or process to meet desired needs with in realistic constraints.
- To develop an ability to identify, formulate, and solve engineering problems.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Impart design skills to the students to apply these skills for the problems in real life industrial applications.
- Develop an holistic design approach to find out pragmatic solutions to realistic domestic and industrial problems.

UNIT–I

Introduction: Principles of gear tooth action, Generation of Cycloid and Involute gears, Involutometry, gear manufacturing process and Inspection, gear tooth failure modes, stresses, selection of right king 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.

Gear Failures: Analysis of gear tooth failures, Nomenclature of gear tooth wear and failure, tooth breakage, pitting, scoring, wear, overloading, gear-casing problems, lubrication failures.

UNIT–III

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 consideration. Design of gear shaft and bearings.

UNIT–IV

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–V

Gear Trains: Simple, compound and epicyclic gear trains, Ray diagrams, Design of a gearbox 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, Constrains 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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Analytical mechanics of gears/ Earle Buckingham/ Dover publications, New York, . 1949.
2. Hand book of gear design/ G.M.Maitha / Tata McGraw Hill publishing company Ltd, . New Delhi, 1994.
3. Machine Design / Shaum series / McGraw Hill.

Course Outcomes:

After Completion of this course students will get

- Ability to select appropriate materials for a design, considering manufacturability, availability, cost, performance, suitability for the conditions, potential failure modes, environmental impact, and other considerations.
- Ability to evaluate the importance of an engineering decision, select an appropriate decision-making process, and implement that process to make a defensible engineering decision.
- Ability to model, analyze, design, and realize a mechanical system that meets a particular need.
- To understand and apply principles of gear design to spur gears and industrial spur gear boxes.
- To become proficient in Design of Helical and Bevel Gear.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**
3/-/3

(R22D1505) THEORY OF ELASTICITY AND PLASTICITY
(PROGRAM ELECTIVE–I)

Course Objectives:

- To understand the theory of stress, strain, and plasticity and enlighten the advances in plasticity and plastic strain analysis.
- To obtain the stress-strain relation within the elastic body and find the principal stress and strain for different types of elastic bodies
- To know yield criteria for ductile metal.
- To understand the plastic stress-strain relations and learn Upper and lower bound theorems and corollaries.
- To understand the concepts of plasticity, yield criteria, plastic flow, etc.,

UNIT-I

Elasticity: Two-dimensional stress analysis - Plane stress - Plane strain - Equations of compatibility - Stress function - Boundary conditions.

Problem in Rectangular Coordinates - Solution by polynomials - Saint Venent's principles - Determination of displacement - Simple beam problems.

Problems in Polar Coordinates - General equations in polar coordinates - Stress distribution symmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

UNIT-II

Analysis of Stress and Strain in Three Dimensions: Principal stresses - Homogeneous deformations - Strain spherical and deviatoric stress - Hydrostatic strain.

General Theorems: Differential equations of equilibrium and compatibility - Displacement - Uniqueness of solution - Reciprocal theorem.

UNIT-III

Bending of Prismatic Bars: Stress function - Bending of cantilever beam - Beam of rectangular cross-section - Beams of circular cross-section.

UNIT-IV

Plasticity: Plastic deformation of metals - Structure of metals - Deformation - Creep stress relaxation of deformation - Strain rate condition of constant maximum shear stress - Condition of constant strain energy - Approximate equation of plasticity.

UNIT-V

Methods of Solving Practical Problems: The characteristic method - Engineering method - Compression of metal under press - Theoretical and experimental data drawing.

TEXT BOOKS:

1. Theory of Elasticity/Timoshenko S.P. and Goodier J.N./Koakusha Publishers
2. An Engineering Theory of Plasticity/E.P. Unksov/Butterworths
3. Applied Elasticity/W.T. Wang/TMH

REFERENCE BOOKS:

1. Theory of Plasticity for Engineers/Hoffman and Sacks/TMH
2. Theory of Elasticity and Plasticity/Sadhu Singh/ Khanna Publishers
3. Theory of Elasticity and Plasticity/Harold Malcolm Westergaard/Harvard University Press

Course Outcomes:

After Completion of this course, students will be able to

- Understand the stress and strain tensor field.
- Understand the contact stresses analysis problem in bearing.
- Understand advanced concepts of plasticity and plastic deformation analysis
- Students can demonstrate Idealized stress-strain diagrams for different material models
- Demonstrate experimental verification of the Prandtl-Reuss equation.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**
3/-/3

(R22D1506) ADVANCED MECHANICS OF COMPOSITE MATERIALS (PROGRAM ELECTIVE–II)

Course Objectives:

- To develop an understanding of the linear elastic analysis of composite materials.
- To 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.
- Explain the behavior of constituents in the composite materials.
- Enlighten the students in different types of reinforcement.

UNIT–I

Basic Concepts and Characteristics: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites.

Reinforcements: Fibers – Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermostats, Metal matrix and ceramic composites.

UNIT–II

Micromechanics: Unidirectional composites, constituent materials, and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.

Manufacturing Methods: Autoclave, tape production, moulding methods, filament winding, manlayup, pultrusion, RTM.

UNIT–III

Coordinate Transformation: Hooke's law for different types of materials, Hooke's law for two-dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress-strain transformation, Graphic interpretation of stress-strain relations Off–axis, stiffness modulus, off-axis compliance.

Elastic Behavior of Unidirectional Composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

UNIT–IV

Strength of Unidirectional Lamina: Micro mechanics of failure, Failure mechanisms, strength of an orthotropic lamina, strength of a lamina under tension and shear maximum stress and

strain criteria, application to design. The failure envelope, first ply failure, free- edge effects. Micros mechanical predictions of elastic constants

UNIT–V

Analysis of Laminated Composite Plates:

Introduction thin plate theory, especially orthotropic plate, crosses and angle ply laminated plates, problems using thin plate theory.

TEXT BOOKS:

1. Mechanics of Composite Materials/ R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
3. Analysis and performance of fibre Composites/ B. D. Agarwal and L. J. Broutman/ . Wiley Interscience, New York, 1980.

REFERENCE BOOKS:

1. Mechanics of Composite Materials/ Second Edition (Mechanical Engineering)/ Autar K.Kaw Publisher: CRC
2. Analysis of Laminated Composite Structures/ L. R. Calcote/ Van Nostrand Rainfold, NewYork, 1969.
3. Advanced Mechanics of Composite Materials/ Vasiliev &Morozov/Elsevier/ Second Edition

Course Outcomes:

- An ability to identify the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques.
- An ability to predict the elastic properties of both long and short fiber composites based on the constituent properties.
- An ability to rotate stress, strain and stiffness tensors using ideas from matrix algebra.
- A basic understanding of linear elasticity with emphasis on the difference between isotropic and anisotropic material behavior.
- An ability to analyze a laminated plate in bending, including finding laminate properties from lamina properties and find residual stresses from curing and moisture.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**
3/-/3

(R22D1507) ADVANCED COMPUTER-AIDED DESIGN
(PROGRAM ELECTIVE–II)

Course Objectives:

- Model the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings.
- Understand the basic analytical fundamentals that are used to create and manipulate geometric models in a computer program. Improve visualization ability of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring.
- Improve visualization ability of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring.
- Model complex shapes including freeform curves and surfaces. Integrate the CAD system and the CAM system by using the CAD system for modeling design Information and converting the CAD model into a CAM model for modeling the manufacturing Information.
- Use full-scale CAD/CAM software systems designed for geometric modeling of machine Components and automatic generation of manufacturing information.

UNIT-I

Principles of Computer Graphics: Introduction, graphic primitives, point plotting, lines, Bresenham's circle algorithm, ellipse, transformation in graphics, coordinate systems, viewport, 2D and 3D transformation, hidden surface removal, reflection, shading and generation of characters.

UNIT-II

Cad Tools: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling, and viewing, software documentation, efficient use of CAD software

Geometric Modelling: Types of mathematical representation of curves, wireframe models wireframe entities parametric representation of synthetic curves her mite cubic splines Bezier curves B-splines rational curves.

UNIT-III

Surface Modeling: Mathematical: representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, the surface of revolution, Tabulated Cylinder.

UNIT-IV

Parametric Representation of Synthetic Surfaces: Hermite Bicubic surface, Bezier surface, B-Spline surface, COONs surface, Blending surface Sculptured surface, Surface manipulation — Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D)

UNIT-V

Geometric modelling-3D: Solid modeling, Solid Representation, Boundary Representation (13-rep), Constructive Solid Geometry (CSG).

CAD/CAM Exchange: Evaluation of data-exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF. Design Applications: Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly.

Collaborative Engineering: Collaborative Design, Principles, Approaches, Tools, Design Systems.

TEXT BOOKS:

1. Mastering CAD/CAM / Ibrhim Zeid / Mc Graw Hill International.
2. CAD/CAM Principles and Applications/ P.N.Rao/TMH/3rd Edition
3. CAD/CAM /Groover M.P./ Pearson education

REFERENCE BOOKS:

1. CAD/CAM Concepts and Applications/ Alavala/ PHI
2. CAD / CAM / CIM, Radhakrishnan and Subramanian/ New Age
3. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson

Course Outcomes:

After Completion of this course students will be able to

- Understand the concepts of wireframe, surface and solid modeling and part modeling and part data exchange standards (VDA, IGES, and STEP).
- Develop knowledge in 2D-Transformations, 3D Transformations and the Assembly Modeling, Assembly tree, and Assembly Methods.
- The Students become experts on Visualization and computer animation Techniques.
- Identify and interpret information provided in technical drawings, schematics, or mask sets.
- Analyze relationships between design elements for parametric modeling.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**
3/-/3

(R22D1508) APPLIED TRIBOLOGY
(PROGRAM ELECTIVE–II)

Course Objectives:

- Understanding the principles for selecting compatible materials for minimizing friction and wear in machinery and the principles of bearing selection and bearing arrangement in machines.
- Learn the computations required for selecting and designing bearings in machines and the fundamental principles of lubrication for reduction of friction and Wear.
- Understanding the fundamental principles of high contact stresses (Hertz stresses), Fatigue-failure and Elasto hydrodynamic (EHD) lubrication in rolling bearings and gears.
- Describe the viscosity and laws of fluid flow with reference to lubrication.
- Illustrate the behavior of tribological components subjected to different working conditions and describe different tribological measures.

UNIT-I

Historical Background - Viscosity - Viscometry - Effect of temperature on viscosity - Effect of pressure in viscosity - Other physical properties of mineral oils - The generalized Reynolds equation - Flow and shear stress - The energy equation - The equation of state - Mechanism of pressure development.

UNIT-II

Circumferential Flow - Oil flow through a bearing having a circumferential oil groove - Heat generation and lubricant temperature - Heat balance and effective temperature - Bearing design: Practical considerations - Design of journal bearings - Parallel surface bearing - Step bearing - Some situations under squeeze film lubrication - The mechanism of hydrodynamic instability - Stiffness and damping coefficients - Stability.

UNIT-III

Elasto Hydrodynamic Lubrication: Theoretical consideration - Grubin type solution - Accurate solution - Point contact - Dimensionless parameters - Film thickness equations - Different regimes in EHL contact - Deep-groove radial bearings - Angular contact bearings - Thrust ball bearings - Geometry - Kinematics - Stress and deformations - Load capacity.

UNIT-IV

Surface Topography - Surface characterization - Apparent and real area of contact - Derivation of average Reynolds equation for partially lubricated surface - Effect of surface roughness on journal bearings

UNIT-V

Laws of Friction - Friction theories - Surface contaminants - Frictional heating - Effect of sliding speed on friction - Classification of wear - Mechanisms of wear - Quantitative laws of wear - Wear resistance materials.

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.

REFERENCE BOOKS:

1. Neale MJ, (Editor) — Tribology hand Book Neumann Butterworths, 1975.
2. Connor and Boyd JJO (Editors) — Standard handbook of lubrication engineers ASLE, Mc
3. Introduction to Tribology of Bearings by Majumdar, B.C

Course Outcomes:

- Students will demonstrate a basic understanding of friction, lubrication and wear processes and familiar with mathematical tools used to analyze tribological processes.
- Students will become familiar with common anti-friction and anti-wear components and the lubricants used therein.
- Students will be able to describe the detailed operation of selected anti-friction or anti-wear components.
- The student can identify different areas of Industrial Tribology.
- Can find the applications of all the areas in day-to-day life.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**
3/-/3

(R22DHS53) RESEARCH METHODOLOGY & IPR

Course Objectives

- Demonstrate the ability to choose methods appropriate to research aims and objectives
- Identify appropriate research topics
- Prepare a project proposal (to undertake a project) • organize and conduct research (advanced project) in a more appropriate manner
- Write a research report and thesis
- Write a research proposal (grants)

UNIT - I

Introduction: Research objective and motivation, Types of research, Research approaches, Significance, Research method vs. methodology, Research process.

UNIT - II

Formulating a research problem: Literature review, Formulation of objectives, Establishing Operational definitions, identifying variables, constructing hypotheses.

UNIT - III

Research design and Data Collection: Need and Characteristics, Types of research design, Principles of Experimental research design, Method of data collection, Ethical issues in collecting data.

UNIT - IV

Sampling and Analysis of data: Need of Sampling, Sampling distributions, Central limit theorem, Estimation: mean and variance, Selection of sample size Statistics in research, Measures of Central tendency, Dispersion, asymmetry and relationships, Correlation and Regression analysis, Displaying data

UNIT - V

Hypothesis Testing: Procedure, Hypothesis testing for difference in mean, variance limitations, Chi-square test, Analysis of variance (ANOVA), Basic principles and techniques of writing a Research Proposal

Text Books:

1. R. C. Kothari, Research Methodology: Methods and Techniques, 2nd edition, New Age International Publisher, 2009

2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005

References:

1. Trochim, William M. The Research Methods Knowledge Base, 2nd Edition. Internet WWW page, at URL: <http://www.socialresearchmethods.net/kb/>
2. (Electronic Version): StatSoft, Inc. (2012). Electronic Statistics Textbook. Tulsa, OK: StatSoft. WEB: http://www.statsoft.com/textbook/.(Printed Version): Hill, T. & Lewicki, P. (2007). STATISTICS: Methods and Applications. StatSoft, Tulsa, OK.

Course Outcomes:

- Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling.
- Construct a coherent research proposal that includes an abstract, introduction, literature review, research questions, ethical considerations, and methodology
- Have basic knowledge on qualitative research techniques
- Have adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis
- Have basic awareness of data analysis-and hypothesis testing procedures.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**
-/3/2

(R22D1581) KINEMATICS AND DYNAMICS LABORATORY

Course Objectives:

- To equip students with an understanding of the fundamental principles and techniques for identifying different types of dynamic systems classifying them by their governing equations.
- To develop a model of a mechanical system using a free-body diagram.
- To develop equations of motion for translational and rotational mechanical systems.
- To develop an understanding of how property data is generated and reported.
- To create a bridge between theoretical knowledge and application.

LIST OF 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 the 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. Study of un-damped natural frequencies.
10. Study of frequencies with various springs arranged in series and parallel.

Note: Any 8 experiments may be conducted.

Course Outcomes:

As an outcome of completing this course, students will be able to:

- Plan, conduct, analyze and evaluate experiments.
- Compare analytical and theoretical results.
- Understand static and dynamic balance.
- Understand forward and inverse kinematics of open-loop mechanisms.
- Communicate FFT test results through presentation (graphical or oral).

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year I Sem **L/P/C**

-/3/2

(R22D1582) ADVANCED COMPUTER-AIDED MODELLING LAB

OBJECTIVES

- To impart knowledge about preparing drawings for various mechanical components using commercially available 3D modeling software.
- To impart training for modeling of components and assembly.
- To impart knowledge to analyze engineering problems.
- To study the conversion of 3D models and different views.
- To understand fits and tolerance in detail for Mechanical components.

LIST OF EXPERIMENTS:

1. Development of part drawings for various components in the form of orthographic and isometric.
2. Generation of various 3D Models through pad, shaft, and shell sweep.
3. Feature-based and Boolean-based modeling surface and Assembly Modeling. Design simple components.
4. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.
5. To make an isometric dimensional drawing of a connecting rod.
6. Draw Different type's bolts and nuts with internal and external threading in Acme and Square threading standards. Save the bolts and nut as blocks suitable for insertion.
7. To model and assemble the flange coupling as per the dimensions given and also convert the 3D model into different views
8. To model and assemble the Screw jack as per the dimensions given and also convert the 3D model into different views.
9. To model and assemble the strap joint of Gib & cotter as per the dimensions given and also convert the 3D model in to different view.
10. Various Dimensioning and tolerance techniques on typical products using CAD software.

Note: Any 8 experiments may be conducted.

COURSE OUTCOMES

- Students should be able to use modeling software for modeling.
- Able to use tolerance &Geometric Dimensioning analysis of a product.
- Students should be able to use software to model a consumer product and industrial robot.
- Able to convert 3D model into different views.
- Able to do dimensioning and tolerance techniques for different products using CAD software.

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M.Tech MD I Year I Sem **L/P/C**
2/-/-

(R22DHS54) VALUE EDUCATION
(AUDIT COURSE –I)

Course Objective:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Understand the four work objectives of the disaster management.
- They Know the key personnel or specialists related to disaster management and associate them with the types of disasters and phases in which they are useful.
- To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts, and public health consequences.
- To ensure skills and ability to design, implement and evaluate research on disasters.

UNIT I:

Values and self-development

Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation. Standards and principles, Value judgments

UNIT II:

Importance of cultivation of values

Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III:

Personality and Behavior Development

Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, doing best for saving nature

UNIT IV:

Character and Competence

Holy books vs Blind faith, Self-management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

Text Books/Reference Books:

- Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
- Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.
- Central Water Commission, 1987, Flood Atlas of India, CWC, New Delhi.
- Central Water Commission, 1989, Manual of Flood Forecasting, New Delhi.
- Government of India, 1997, Vulnerability Atlas of India, New Delhi.

- Sahni, Pardeep Et.Al. (Eds.) 2002, Disaster Mitigation Experiences and Reflections. Prentice Hall of India, New Delhi.

Course Outcomes:

- Students will be able to affirm the usefulness of integrating management principles in disaster mitigation work.
- Students can distinguish between the different approaches needed to manage pre-during and post-disaster periods.
- Understanding foundations of hazards, disasters, and associated natural/social phenomena.
- Familiarity with disaster management theory (cycle, phases).
- Capacity to manage the Public Health aspects of disasters.

I YEAR
II SEMESTER

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year II Sem **L/P/C**
3/-/3

(R22D1509) ADVANCED MECHANICS OF MACHINERY

Course Objectives

- Understand the basic principles and concepts of Mechanical Design.
- To study the physics that governs the behavior of various mechanisms.
- Examine the suitability of mechanical devices/products for specific applications.
- Understand the various quantitative and qualitative approaches to the synthesis and modeling of compliant mechanisms.
- To understand the synthesis and path generation of the four-bar mechanism.

UNIT–I

Advanced Kinematics of Plane Motion- I: Introduction to plane motion. The Inflection circle, Euler – Savary Equation, Analytical and graphical determination of di , Bobillier's Construction, Collineation axis Hartmann's Construction, Inflection circle for the relative motion of two moving planes, Application of the Inflection circle to kinematic analysis.

UNIT-II

Advanced 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, Determination 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 a four-bar mechanism.

UNIT-III

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

UNIT-IV

Introduction to Synthesis-Graphical Methods - II: Function generation- General discussion, Function generation: Relative – Roto center method, Overlay's method, Function generation-Velocity – pole method, Path generation: Hrones's and Nelson's motion Atlas, Roberts's theorem.

UNIT–V

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.

TEXT BOOKS:

1. Kinematics and Dynamics of plane mechanisms/ Jeremy Hirschhorn/McGraw-. Hill,1962.
2. Theory of Machines and Mechanisms/ J.E Shigley and J.J . Uicker Jr./ McGraw-Hill, . 1995
3. Theory of Mechanisms and Machines/ Amitabh Ghosh and Ashok Kumar Mallik/E.W.P.Publishers.

REFERENCE BOOKS:

1. Kinematics and Linkage Design/ Allen S.Hall Jr./ PHI,1964.
2. Kinematics and Dynamics of Machinery/Charles E Wilson/Pearson/3rd Edition
3. Mechanics of Machines by Viswanatha Ramamurti.

Course Outcomes

- Understand the metrics that are used to determine/set desired performance.
- Understand the physics that govern the behavior of compliant mechanisms.
- Identify the practical issues that are important to address during integration and implementation.
- Able to understand function and path generation of mechanisms.
- Students are able to understand the graphical and analytical methods for four bar mechanism.

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M.Tech MD I Year II Sem **L/P/C**
3/-/3

(R22D1510) EXPERIMENTAL STRESS ANALYSIS

Course Objectives:

1. To study the relation between the mechanics theory and experimental stress analysis.
2. To establish the fundamental concepts and new experimental techniques.
3. To use the experimental techniques on the practical problems.
4. To make a fine presentation related to the experimental techniques.
5. To study conceptual techniques of 3D photo elasticity and birefringent coatings

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 gauge circuits.

UNIT-II

Recording Instruments: Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems

UNIT-III

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, analysis of brittle coating data.

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

UNIT-IV

Photo Elasticity: Photo elasticity, polariscope, plane and circularly polarized light, bright and dark filed setup, photo elasticity 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, shear-difference method in three dimensions, scattered-light method

Birefringent Coating: Introduction, coating stress and stains, coating sensitivity, coating materials, application of coatings, effective of coating thickness, fringe-order determinations in coatings, stress separation methods.

TEXT BOOKS:

1. Theory of elasticity / Timoshenko and Goodier Jr.
2. Experimental Stress analysis/ Dally and Riley, Mc Graw-Hill
3. Experimental Stress Analysis by James W. Dally, William Franklin Riley

REFERENCE BOOKS:

1. A treatise on Mathematical theory of elasticity / LOVE A.H./ Dover Publications
2. Photo Elasticity / Frocht/ Wiley / 3rd Edition
3. Experimental Stress Analysis: Principles and Methods By G. S. Holister

Course Outcomes:

After Completion of this course students will be able to,

- Apply basic science systematization thought excavation, the evaluation, the diagnosis project question, and plans and carries out ability of the special study and the solution.
- Have independent research, collection the data, standard problem take into analytical the identification and acquire conclusion.
- Able to use mathematical engineering realm is related analysis and design software, explanation data with independently solves the ability of problem.
- Able to understand the methods of photo elasticity.
- Ability to use 3D photo elasticity methods and birefringent coating for different materials.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year II Sem **L/P/C**
3/-/3

(R22D1511) INDUSTRIAL ROBOTICS
(PROGRAM ELECTIVE – III)

Course Objectives:

- To develop the student's knowledge in various robot structures and their workspace.
- To develop student's skills in perform kinematics analysis of robot systems.
- To provide the student with some knowledge and analysis skills associated with Trajectory planning.
- To provide the student with some knowledge and skills associated with robot controls
- To know the industrial applications of robots.

UNIT-I

Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement.

Control System and Components: Basic concept and modais controllers control systematic analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

UNIT-II

Motion Analysis and Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

UNIT-III

End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design. SENSORS: Desirable features, tactile, proximity and range sensors, uses sensors in robotics.

Machine Vision: Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

UNIT-IV

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINONAL AND DELAY commands, Branching capabilities and Limitations.

Robot Languages: Textual robot Languages, Generation, Robot language structures, Elements in function.

UNIT-V

Robot Cell desgin and control: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, Work and control, Inter locks, Error detect ion, Work wheel controller.

Robot Application: Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection, Feature Application.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. ntroduction to Robotic Mechanics and Control / J J Craig/ Pearson / 3rd edition.
3. Robotics / Fu K S/ McGraw Hill.

REFERENCE BOOKS:

1. Robotic Engineering / Richard D. Klafter, Prentice Hall
2. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
3. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pvt. Ltd.

Course Outcomes:

After Completion of this course students will be able to

- Classify robots based on joints and arm configurations.
- Design and applications of specific End Effectors for robots.
- Compute forward and inverse kinematics of robots and determine trajectory plan.
- Program robot to perform typical tasks including Pick and Place, Stacking and Welding.
- Design and select of robots for Industrial applications.

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M.Tech MD I Year II Sem **L/P/C**
3/-/3

(R22D1512) DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS
(PROGRAM ELECTIVE – III)

Course Objective:

- To gain knowledge hydraulic power generators and selection and specifications of pumps
- Impart students on the science, use and application of hydraulics and pneumatics as fluid power in Industry.
- Also, to impart knowledge on the methodology of basic and advanced design of pneumatics and hydraulics systems.
- To understand pneumatic systems and circuits
- To know about Electrical control of pneumatic and Hydraulic circuits.

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, Hydrostatic drives, types, selection.

UNIT - II

Control and Regulation Elements: Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems, Proportional Electro hydraulic servo valves.

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 methodology- design and selection of components - safety and emergency mandrels – Cascade method.

UNIT - IV

Pneumatic Systems and Circuits: Pneumatic fundamentals - control elements, position and pressure sensing, Pneumatic equipments- selection of components - design calculations - 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- Karnaugh - Veitch map.

UNIT V

Electromagnetic & Electronic Control of Hydraulic & Pneumatic Circuit: Electrical control of pneumatic circuits – use of relays, counters, timers, ladder diagrams, use of a microprocessor in circuit design – use of PLC in hydraulic and pneumatic circuits – Fault finding– application - fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low-cost automation - Robotic circuits.

Text Books:

1. Principles of Hydraulic Systems Design, Second Edition Kindle Edition by Peter Chapple (Author)
2. K.Shanmuga Sundaram, "Hydraulic and Pneumatic Controls: Understanding made Easy" S.Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009)

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.

Course Outcome:

- Hydraulic power generators and selection and specifications of pumps and know about actuators.
- Use and application of hydraulics and pneumatics as fluid power in Industries.
- Also to impart knowledge on the methodology of basic and advanced design of pneumatics and hydraulics systems.
- To understand pneumatic systems and circuits
- To again knowledge about Electrical control of pneumatic and Hydraulic circuits.

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M.Tech MD I Year II Sem **L/P/C**
3/-/3

(R22D1513) MECHATRONICS
(PROGRAM ELECTIVE – III)

Course Objectives:

- Have a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies
- Be able to design, analyze, and test "intelligent" products and processes that incorporate Appropriate computing tools sensors, and actuators
- Be able to demonstrate professional interaction and communicate effectively with team Members Be able to work efficiently in multidisciplinary teams
- Be prepared for a variety of engineering careers, graduate studies, and continuing education
- Practice professional and ethical responsibility, and, be aware of the impact of their designs on human-kind and the environment.

UNIT-I

Mechatronics systems, elements, levels of Mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of Mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

UNIT-III

Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT-IV

Digital electronics and systems, digital logic control, microprocessors, and microcontrollers programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V

System and interfacing and data acquisition, DAQS, SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of Mechatronics systems & future trends

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran & GK Vijaya Raghavan/WILEY India Edition/2008.
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.
3. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.

REFERENCE BOOKS:

1. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
2. Mechatronics System Design / Devdas shetty/Richard/Thomson.
3. Mechatronics/M.D.Singh/J.G.Joshi/PHI.

Course Outcomes:

Mechatronics engineering graduates will be able to:

1. Employ the knowledge of mathematics, science, and engineering. Design and conduct experiments to evaluate the performance of a Mechatronics system or component with respect to specifications, as well as to analyze and interpret data.
2. Design Mechatronics component, system or process to meet desired needs
3. Define and solve engineering problems. Use the techniques, skills, and modern Mechatronics engineering tools necessary for engineering practice.
4. Communicate technical matters effectively in oral, written, and graphical form
5. Identify and evaluate ethical ramifications and professional responsibilities in a variety of situations.

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M.Tech MD I Year II Sem **L/P/C**
3/-/3

(R22D1514) COMPUTER INTEGRATED MANUFACTURING
(PROGRAM ELECTIVE – IV)

Course objectives:

The students will learn to:

- Explain basic concepts of CIM systems and Develop machining programs for CNC equipment
- Develop PLC-based control systems for manufacturing cells
- Design CIM systems to fulfill certain requirements
- Identify and solve problems in the operations of CIM systems
- Enhance performance of manufacturing systems by applying different CIM concepts and tools

UNIT-I

Introduction: Scope of computer-integrated manufacturing, Product cycle, and Production automation.

Group technology: Role of group technology in CAD/CAM integration, Methods for developing part families, Classification and coding, Examples of coding systems, Facility design using group technology, Economics of group technology.

UNIT-II

Computer-Aided Process Planning: Approaches to process planning - Manual, Variant, Generative approach, Process planning systems - CAPP, DCLASS, CMPP, Criteria for selecting a CAPP system, Part feature recognition, Artificial intelligence in process planning.

UNIT-III

Integrative Manufacturing Planning and Control: Role of integrative manufacturing in CAD/CAM integration, Overview of production control - Forecasting, Master production schedule, Capacity planning, M.R.P., Order release, Shop-floor control, Quality assurance, Planning and control systems, Cellular manufacturing, JIT manufacturing philosophy.

UNIT-IV

Computer-Aided Quality Control: Terminology in quality control, Contact inspection methods,

Noncontact inspection methods, Computer aided testing, Integration of CAQC with AD/CAM.

UNIT-V

Computer Integrated Manufacturing Systems: Types of manufacturing systems, Machine tools and related equipment, Material handling systems, Computer control systems, FMS.

TEXT BOOKSS:

1. CAD/CAM Principles and Applications by P.N. Rao, Tata McGraw Hill Publishing Company Ltd.
2. CAD/CAM Computer Aided Design and Manufacturing Mikell P. Groover and Emory W. Zimmer, Jr.
3. Computer Integrated Design and Manufacturing by David D. Bedworth, Mark R.Henderson, Philip M. Wolfe.

REFERENCE BOOKS:

1 Automation, Production Systems and Computer Integrated Manufacturing .by Mikell P. Groover, Prentice Hall of India Pvt. Ltd.

2 Principles of Computer Integrated Manufacturing by Vajapayee, Prentice Hall of India Pvt. Ltd.

3 Computer Integrated Manufacturing by A. Alavudeen, N. Venkateshwaran

Course Outcomes:

This course primarily contributes to Mechanical Engineering program outcomes:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- Ability to understand process planning and product panning techniques.
- An ability to identify, formulate, and solve engineering problems
- knowledge of contemporary issues an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

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M.Tech MD I Year II Sem **L/P/C**
3/-/3

(R22D2112) COMPUTATIONAL FLUID DYNAMICS

Course Objectives:

- To develop finite difference and finite volume discredited forms of the CFD equations.
- To formulate explicit & implicit algorithms for solving the Euler Equations & Navier Stokes Equations.
- Equip students with the knowledge base essential for the application of computational fluid dynamics to engineering flow problems.
- Provide the essential numerical background for solving the partial differential equations governing the fluid flow
- Develop students' skills of using a commercial software package

UNIT-I

Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution Methods: Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination.

Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT–II

Hyperbolic Equations: Explicit schemes and Von Neumann stability analysis, implicit schemes, multi-step methods, nonlinear problems, second-order one-dimensional wave equations.

Burger's equations: Explicit and implicit schemes, Runge-Kutta method.

UNIT–III

Formulations of Incompressible Viscous Flows Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, and vortex methods.

Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

UNIT-IV

Finite Volume Method: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

UNIT–V

Standard Variational Methods: Linear fluid flow problems, steady-state problems, Transient problems.

Course Outcomes:

- Derive the basic governing equations applied for fluid flow problems.
- Apply the differential equations to fluid flow problems and simplify flow problems and solve them exactly
- Understand the concept of discretization and solution of aerodynamic flows.
- Solve simple algorithms for incompressible fluid flow.
- Appraise & compare current CFD software.

TEXTBOOKS:

1. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985
2. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
3. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications

REFERENCE BOOKS:

1. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
2. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities
3. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis Oxford University Press/2nd Edition

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year II Sem **L/P/C**
3/-/3

(R22D1515) ADVANCED MECHANICAL VIBRATIONS
(PROGRAM ELECTIVE – IV)

Course Objectives:

- To know about damped and undamped free vibrations
- Students will be able to learn how to deal with the phenomena of vibrations by transforming the physical model into a mathematical model.
- Getting the response of a physical model
- Solving the mathematical model, analyzing the response and bring its physical concept.
- To know about the numerical methods

UNIT-I

Single Degree of Freedom Systems: Undamped and damped free vibrations; forced vibrations coulomb damping, Response to 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

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, Eigenvalue 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.

Vibration Measuring Instruments: Vibrometers, velocity meters & accelerometers.

UNIT-IV

Frequency Domain Vibration Analysis: Overview, machine-train monitoring parameters-Data base development-vibration data acquisition-trending analysis-failure- node analysis-signature analysis-root cause analysis.

UNIT-V

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

TEXT BOOKS:

1. Mechanical Vibrations/Groover/Nem Chand and Bros
2. Elements of Vibration Analysis by Meirovitch, TMH, 2001
3. Mechanical Vibrations/Schaum Series/ McGraw Hill

REFERENCE BOOKS:

1. Mechanical Vibrations / SS Rao/ Pearson/ 2009, Ed 4,
2. Mechanical Vibrations/Debabrata Nag/Wiley
3. Vibration problems in Engineering / S.P. Timoshenko.

Course Outcomes:

After Completion of this course, students will be able to

- Understand the causes and effects of vibration in mechanical systems and their Classification.
- Solve vibration problems that contain multiple degrees of freedom and obtain design parameters.
- Learn how the vibration measuring instrument works and how to apply the proper instrument for a particular application.
- Analyze a system with infinite degrees of freedom and also be able to find infinite natural frequencies corresponding to infinite principal modes of the systems.
- Apply various numerical methods to solve determinants of higher order when one deals with multi-degree freedom systems

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year II Sem **L/P/C**

-/-/3

(R22D1591) MINI PROJECT

Course Objectives:

- To be able to apply some of the techniques/principles you have been taught
- To carry out budget and time planning for the project.
- To inculcate implementation skills by basics of design using an appropriate analysis tool.
- To follow correct simulation practices
- To do effective methodology in the mini project

Course Outcomes:

- Demonstrate a through and systematic understanding of project contents.
- Understand methodologies and professional way of documentation and communication.
- Know the key stages in development of the project.
- Extend or use the idea in mini project.
- Create new ideas with the help of fundamentals of Mechanical Engineering

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year II Sem **L/P/C**

-/3/2

(R22D1583) ADVANCED COMPUTER-AIDED ANALYSIS LABORATORY

OBJECTIVES

- At the end of this course the students would have developed a thorough understanding of the Computer Aided Finite Element Analysis packages.
- Ability to effectively use the tools of the analysis for solving practical problems arising in engineering design.
- To impart knowledge about fracture analysis and modal analysis.
- To study non-linear, buckling analysis using Computer Aided Finite Element Analysis packages.
- To improve the problem-solving ability using a numerical method like FEA

LIST OF EXPERIMENTS

1. Analysis of Framed structures using FEA software.
2. Perform Fracture analysis for simple problems using FEA software.
3. Analysis of laminated composite structures using FEA software.
4. Perform a simple modal analysis for a cantilever beam using FEA software.
5. Perform Harmonic analysis for a given cantilever beam using FEA.
6. Perform a simple transient analysis for different beams.
7. Non-Linear Analysis: Find the geometric nonlinearity behavior for a cantilever beam subjected to a large moment.
8. Buckling analysis: Solve simple buckling problems using Eigenvalue and nonlinear methods.
9. Stress analysis of a rectangular plate with a circular hole.
10. Thermal Analysis of 1D & 2D problems with conduction and convection boundary conditions.

Note: Any 8 experiments may be performed from the above-listed experiments.

OUTCOMES:

- Students should be able to carry out structural, FEA software for real-time applications.
- Able to do Harmonic analysis using FEA Software.
- Ability to solve and fracture analysis for real-time applications.
- It helps the students to get familiarized with the Computer Aided Finite Element Analysis packages which are necessary to solve engineering problems numerically.
- Able to solve thermal 1D & 2D with conduction and conversion boundary conditions.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year II Sem **L/P/C**
-/3/2

(R22D1584) COMPUTATIONAL DYNAMICS LABORATORY

OBJECTIVES

- To analyze and study the incompressible internal laminar flow of a fluid in a 3D pipe.
- To study the incompressible turbulent flow of a fluid in a 3D pipe.
- To visualize the pressure distribution over a pipe at different velocities.
- To visualize the shock wave boundary layer intersection over a flat plate and plot the velocity profile.
- To visualize the flow through a convergent-divergent nozzle and calculate the flow properties at different velocities.

LIST OF EXPERIMENTS:

1. Solution for the one-dimensional wave equations using the explicit method of lax using finite difference method (code development)
2. Solution for the one-dimensional heat conduction equation using an explicit method using finite difference method (code development)
3. Numerical simulation of Flat plate boundary layer using FEM software
4. Numerical simulation of Laminar flow through pipe using FEM software
5. Numerical simulation of Flow past cylinder using FEM software
6. Numerical simulation of flow through nozzle using FEM software
7. Numerical simulation of combustion using FEM software
8. Simulation of Compressible flow in convergent divergent nozzle.
9. Simulation of compressible flow in a compressor.
10. Six degrees of freedom simulation F-16 model.

Note: Any 8 experiments can be conducted.

OUTCOMES:

- Implement the computational fluid dynamic and computational aerodynamic fundamentals by using advanced solvers.
- Understand the flow properties of flat plate, nozzle and cylinder to demonstrate Reynolds number.
- Differentiate the flow properties around symmetrical and unsymmetrical components.
- Analyze the coefficient of pressure, lift, drag and moment for different bodies for different flow conditions.
- Visualize the flow around the different bodies under different flow conditions

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD I Year II Sem **L/P/C**
3/-/3

(R22DHS55) ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course – II)

INTRODUCTION

Writing a research paper is a significant part of any academia. It is a substantial piece of academic writing in which the author does independent investigation into a topic and writes a description of the findings of that study. Research studies are important because these contribute to a scholar's knowledge and also provide solutions to the latest challenges. Writing forces one to think about what he believes and what he wants to communicate. Since good writing skills allow a learner to communicate his message with clarity, an extensive exposure on techniques of writing research paper proves to be an immense value to the students.

OBJECTIVES

- To enable the students to use linguistic structures to form well-organized texts in research contexts
- To improve the quality of a composition by using appropriate cohesive devices
- To enhance the mechanics of writing skills using correct grammar and vocabulary
- To equip learners with the strategies of error – free writing

SYLLABUS

UNIT-I - Sentence Formation
Word order, structuring paragraphs, Breaking up long sentences

UNIT-II - Cohesive devices
Types of cohesive devices - Anaphoric reference, Cataphoric reference, Exophoric reference
Tense agreement

UNIT-III – Academic Vocabulary
Hedging, Transitions – Additive, Adversative, Causal, Sequential

UNIT-IV – Grammar for Research Papers
Active & Passive, Punctuation, Articles

UNIT-V – Academic writing
Removing redundancy, Avoiding ambiguity, Paraphrasing, Sample Abstracts for practice, Sample videos

*** Exercises apart from the text book shall also be referred for classroom tasks.**

REFERENCE BOOKS:

1. English for Writing Research Papers. Adrian Wallwork, edition II, Springer, 2016.
2. Handbook of Technical Writing. James H. Shelton, McGraw Hill, 1994
3. Writing the Research Paper, a handbook. 8th edition, Anthony C. Winkler, Jo Ray Metherell, Wadsworth, 2012

OUTCOMES:

Students will be able to:

- Write in a clear, coherent, and direct style appropriate for academic research
- Draft coherent and unified paragraphs with adequate supporting details.
- Develop the strategy to use lexical terms effectively.
- Adopt appropriate syntactic and semantic techniques
- Demonstrate analytical and inferencing skills.
- Comprehend and employ the various forms of scholarly composition.

II YEAR

I SEMESTER

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M.Tech MD II Year I Sem **L/P/C**
3/-/3

(R22D1516) DESIGN FOR THE INTERNET OF THINGS
(PROGRAM ELECTIVE – V)

COURSE OBJECTIVES:

- Understand general concepts of the Internet of Things (IoT).
- Recognize various devices, sensors and applications.
- Apply design concept to IoT solutions.
- Analyze various IoT architectures.
- Evaluate design issues in IoT applications.

UNIT I

Introduction to IOT: What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

UNIT II

SENSORS AND APPLICATIONS: Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT III

DESIGN CONCEPT: IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

UNIT IV

IOT ARCHITECTURES: Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

UNIT V

DEVELOPING IOT SOLUTIONS: IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH,

Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture.

TEXT BOOKS

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017.

REFERENCES

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 stEdition, VPT, 2014.
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.

COURSWE OUTCOMES:

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year I Sem **L/P/C**
3/-/3

(R22D1517) DESIGN FOR MANUFACTURE ASSEMBLY AND ENVIRONMENT (PROGRAM ELECTIVE – V)

OBJECTIVES:

- To identify the manufacturing constraints that influences the design of parts and part systems.
- Students will be introduced to the Design for Manufacturability (DFM) methodology, and will be motivated to understand infeasible or impractical designs.
- To understand the design considerations and applications of DFMA.
- To know the concept of design for manufacturing, assembly and environment.
- To know the computer application in design for manufacturing and assembly.

UNIT I

INTRODUCTION: General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

UNIT II

FACTORS INFLUENCING FORM DESIGN: Working principle, Material, Manufacture, Design-Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

UNIT III COMPONENT DESIGN - MACHINING CONSIDERATION: Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.

UNIT IV

COMPONENT DESIGN – CASTING CONSIDERATION: Redesign of castings based on parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

UNIT V

DESIGN FOR THE ENVIRONMENT: Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application –

Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.

TEXT BOOKS

1. Boothroyd, G, 1980 Design for Assembly Automation and Product Design. New York, Marcel Dekker.
2. Bralla, Design for Manufacture handbook, McGraw hill, 1999.

REFERENCES

1. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.
2. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995.
3. Fixel, J. Design for the Environment McGraw hill., 1996.

COURSE OUTCOMES:

- Understand the quality aspects of design for manufacture and assembly
- Apply Boothroyd method of DFM for product design and assembly
- Apply the concept of DFM for casting, welding, forming and assembly
- Identify the design factors and processes as per customer specifications
- Apply the DFM method for a given product

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD- II Year I Sem **L/P/C**
3/-/3

(R22D1518) MEMS: DESIGN FABRICATION AND CHARACTERISATION (PROGRAM ELECTIVE – V)

OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices
- To educate on the rudiments of Micro fabrication techniques
- To introduce various design and analysis techniques
- To study about MEMS characterization.
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering

UNIT I

INTRODUCTION: Intrinsic Characteristics of MEMS – Energy Domains and Transducers-Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II

FABRICATION: Conventional MEMS fabrication using VLSI technology: lithography, chemical etching: isotropic and anisotropic, Plasma etching, reactive ion etching (RIE), oxidation, chemical vapour deposition (CVD), LPCVD, PECVD, surface micromachining, LIGA, single layer, and higher layer fabrication. Non-conventional MEMS fabrication: laser micromachining and welding, processing of metals and nonmetals with laser, Electro Discharge and Electro Chemical micromachining (EDM and ECM), Micro stereolithography: scanning process, dynamic mask process. Electronic packaging

UNIT III

DESIGN AND ANALYSIS: Basic concepts of design of MEMS devices and processes, Design for fabrication, other design considerations, Analysis of MEMS devices, FEM and Multiphysics analysis, Modeling and simulation, connection between molecular and continuum mechanics, MEM system level analysis from perspective of control theory.

UNIT IV

CHARACTERIZATION: Technologies for MEMS characterization, Scanning Probe Microscopy (SPM): Atomic Force Microscopy (AFM), Scanning tunneling microscopy (STM), Magnetic Force Microscopy, Scanning Electron Microscope, Laser Doppler vibrometer, Electronic Speckle Interference Pattern technology (ESPI).

UNIT V

POLYMER AND OPTICAL MEMS: Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TEXT BOOKS:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

COURSE OUTCOMES:

- Ability to understand the operation of micro devices, micro systems and their applications
- Ability to design the micro devices, micro systems using the MEMS fabrication process
- Knowledge about MEMS design, process and fabrication methods.
- Ability to understand various testing methods for MEMS characterization.
- Understand about various applications used to actuators.

OPEN ELECTIVE

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year I Sem **L/P/C**
3/-/3

(R22DME51) NON-CONVENTIONAL ENERGY SOURCES
(OPEN ELECTIVE - I)

Course Objectives:

- To explain the concept of various forms of renewable energy.
- To outline division aspects and utilization of renewable energy sources for both domestic and industrial applications.
- To impart the knowledge of basics of different nonconventional types of power generation & power plants in detail.
- Understanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are scarce in nature.
- Students learn different sources and conversion techniques for a better society

UNIT-I

Introduction: Energy Scenario, Survey of energy resources. Classification and need for conventional energy resources.

Solar Energy: The Sun-sun-Earth relationship, Basic matter to waste heat energy circuit, Solar Radiation, Attention, Radiation measuring instruments.

Solar Energy Applications: Solar water heating. Space heating, Active and passive heating, Energy storage, Selective surface, Solar stills and ponds, solar refrigeration, Photovoltaic generation.

UNIT -II

Geothermal Energy: Structure of earth, Geothermal Regions, Hot springs. Hot Rocks, Hot Aquifers. Analytical methods to estimate thermal potential. Harnessing techniques, Electricity generating systems.

UNIT-III

Direct Energy Conversion: Nuclear Fusion, Fusion reaction, P-P cycle, Carbon cycle, Deuterium cycle, Condition for controlled fusion, Fuel cells and photovoltaic, Thermionic and Thermoelectric generation and MHD generator.

Hydrogen Gas as Fuel: Production methods, Properties, I.C. Engines applications, Utilization strategy, Performances.

UNIT-IV

Bioenergy: Biomass energy sources. Plant productivity, Biomass wastes, aerobic and anaerobic bioconversion processes, Raw material and properties of bio-gas, Bio-gas plant technology and status, the energetic and economics of biomass systems, Biomass gasification

UNIT-V

Wind Energy: Wind, Beaufort number, Characteristics, Wind energy conversion systems, Types, Betz model. Interference factor. Power coefficient, Torque coefficient, and Thrust coefficient lift machines and Drag machines. Matching Electricity generation.

Energy from Oceans: Tidal energy, Tides, Diurnal and semi-diurnal nature, Power from tides, Wave Energy, Waves, Theoretical energy available. Calculation of period and phase velocity of waves, Wave power systems, and submerged devices. Ocean thermal Energy, Principles, Heat exchangers, Pumping requirements, Practical considerations.

Course Outcomes:

- Students get expertise in analyzing the environmental sources.
- Cost economics of using renewable energy sources compared to fossil fuel.
- Students get exposure on direct energy conversion systems.
- Student expertise the need and role of Non-Conventional Energy sources
- Recognize the need and ability to engage in lifelong learning for further developments in this field

TEXTBOOKS:

1. Non-conventional Energy Sources / GD Rai/Khanna publications.
2. Non-Conventional Energy Sources and Utilisation (Energy Engineering)/ R K Rajput / S.Chand.
3. Renewable Energy Sources /Twidell & Weir/Taylor and Francis/ 2nd special Indian edition.

REFERENCE BOOKS:

1. Renewable Energy Resources- Basic Principles and Applications/ G.N.Tiwari and M.K.Ghosal/ Narosa Publications.
2. Renewable Energy Resources/ John Twidell & Tony Weir/Taylor & Francis/2nd edition.
3. Non Conventional Energy / K.Mittal/ Wheeler.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year I Sem **L/P/C**
3/-/3

(R22DME52) INDUSTRIAL SAFETY
(OPEN ELECTIVE -I)

Course Objectives:

- Students will be able to recognize and evaluate occupational safety and health hazards in the workplace
- To explain the concept of various industrial safety methods. To outline division aspects measurements of safety performance.
- To study about various safety conditions and environments.
- Able to analyze the effects of workplace exposures, injuries and illnesses, fatalities
- To determine appropriate hazard controls following the hierarchy of controls

UNIT-I:

Importance of Safety, health and environment. Health safety and environmental policy, fundamentals of safety, classification of accidents, Managements responsibility, objectives of safety management, National safety council, Employees state insurance act 1948, approaches to prevent accidents, principles of safety management, safety organization, safety auditing, maintenance of safety, measurements of safety performance, industrial noise and noise control, Industrial Psychology, Industrial accidents and prevention. Introduction to OSHAS 18001 AND OSHA.

UNIT II:

Process safety management (P.S.M) as per OSHA, legal aspects of safety, safety with respect to plant and machinery, the explosive act 1884, Petroleum act 1934, personal protective equipment, classification of hazards, protection of respiratory system, work permit system, hazards in refineries and process plants, safety in process plants, pollution in some typical process industry.

UNIT III:

Safe working practices, housekeeping, safe working environment, safety device and tools, precaution in use of ladders, safety instruction during crane operation, safety instruction for welding, burning and cutting and gas welding equipment, electrical safety, case studies, safety in use of electricity, electric shock phenomena, Occurrence of electric shock, medical analysis of electric shock and its effect, safety procedures in electric plants, installation of earthing system,

UNIT IV:

Safety in hazardous area, hazard in industrial zones, classification of industrial Enclosures for gases and vapors. Mechanical, Chemical, Environmental and Radiation hazards, Machine guards and safety devices, slings, load limits, lifting tackles and lifting equipment, hydrostatic test, Chemical hazards, industrial toxicology, toxic chemicals and its harmful effects on

humans, factors influencing the effect of toxic materials, Units of concentration, control measure, environmental hazards, devices for measuring radiation, safety analysis and risk analysis, risk management, First aid, Safety measures to avoid occupational diseases.

UNIT V

Factories act – 1948 Stuatutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures- Indian Boiler Act 1923, static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines act 1952, workman compensation act, rules – electricity act and rules.

Course Outcome:

- Evaluate workplace to determine the existence of occupational safety and health hazards
- Identify relevant regulatory and national consensus standards along with best practices that are applicable
- Educate students about how to reduce work place hazards and to encourage the standard of Safety, Health & Environment programme , so as to aim 0% accidents and 100% safety in different industries in which Industrial Safety plays an important role.
- Select appropriate control methodologies based on the hierarchy of controls
- This has the blending mixture of both Learning and Skills.

Text Books:

1. Industrial safety management By: L.M. Deshmukh Publishers: Tata Mcgraw Hill ,New Delhi Year: 2006 Edition: First
2. The Factories Act 1948, Madras Book Agency, Chennai, 2000

References:

1. Industrial safety health and environment Management system By: R.K. Jain & Sunil S. Rao Publishers: Khanna Publishers Year: 2008 Edition: Second
2. The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
3. ”Accident prevention manual for industrial operations”, N.S.C.,Chicago, 1982.
4. Industrial Safety and Environment by Amit Gupta
5. “Safety in Industry” N.V. Krishnan Jaico Publishery House, 1996.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year I Sem **L/P/C**
3/-/3

(R22DME53) OPERATIONS RESEARCH
(OPEN ELECTIVE -I)

Course Objectives:

- To familiarize the students with the use of practice-oriented mathematical applications for optimization functions in an organization.
- To familiarize the students with various tools of optimization, probability, statistics, and simulation,
- To be applicable in particular scenarios in industry for better management of various resources.
- To develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language.
- Understandable to the decision-making processes in Management Engineering.

UNIT–I

Introduction: Development – Definition– Characteristics and Phases – Types of models – operation Research models– applications.

Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method –Artificial variables techniques -Two–phase method, Big-M method.

UNIT–II

Transportation Problem – Formulation – Optimal solution, unbalanced transportation problem –Degeneracy. Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem-Traveling Salesman problem.

Sequencing – Introduction – Flow **–**Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.

UNIT–III

Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement.

Theory of Games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle – m X 2 & 2 X n games -graphical method.

UNIT–IV

Waiting Lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic

models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT–V

Dynamic Programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages – Simulation Languages.

Course Outcomes:

- Student will be able to illustrate the need to optimally utilize the resources in various types of industries.
- Apply and analyze mathematical optimization functions to various applications.
- Demonstrate cost effective strategies in various applications in industry.
- Student will be able to implement these Techniques in real Life.
- Student can use this mathematical software to solve the proposed models.

TEXT BOOKS:

1. Operations Research / S.D.Sharma-Kedarnath
2. Introduction to O.R/Hiller &Libermann (TMH).
3. Introduction to O.R /Taha/PHI

REFERENCE BOOKS:

1. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.
2. Operations Research / R.Pannerselvam,PHI Publications.
3. Operation Research /J.K.Sharma/MacMilan.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year I Sem **L/P/C**
3/-/3

(R22DHS51) BUSINESS ANALYTICS
(OPEN ELECTIVE -I)

Course Objectives:

- To understand the importance of ever-increasing volume, variety and velocity of data in organization and application of data analytical tools for decision making.
- Students will demonstrate ethical reasoning skills, understand social, civic, and professional responsibilities and aspire to add value to society.
- Students will effectively communicate using business specific terminology in written and verbal form.
- Students will utilize interpersonal and leadership skills to be highly effective business managers and leaders.
- Students will have a strategic understanding of business analytics.

Unit-I: Introduction to Business Analytics: Importance, Scope, Evolution, Classification, and Application; Data Structure-Visualization of Data, Data Architecture, Measurement Scale; Decision Models-Classification, Structure of Decision Models; Data Structure and Data View-Understanding of data, exploring data using pivot tables.

Unit-II: Descriptive Analytics: Descriptive Statistical Measures–Population and samples, Measures of location, Measures of Dispersion, Measures of variability, measures of Association. Probability distribution and Data Modelling – Discrete Probability distribution, Continuous Probability distribution, Random sampling from Probability Distribution, Data Modelling, and Distribution fitting.

Unit-III: Predictive Analytics: Karl Pearson Correlation Techniques -Multiple Correlation-Spearman's Rank Correlation-Simple and Multiple Regression-Regression by the method of least squares –Building good regression models –Regression with categorical independent variables --Linear Discriminant Analysis-One way and Two Way ANOVA

Unit-IV: Data Mining: Scope of Data Mining, Data Exploration and Reduction, Unsupervised learning –cluster analysis, Association rules, Supervised learning-Partition Data, Classification Accuracy, prediction Accuracy, k-nearest neighbors, Classification and regression trees, Logistics Regression.

Unit-V: Simulation: Random Number Generation, Monte Carlo Simulation, What if Analysis, Verification and Validation, Advantages and Disadvantages of Simulation, Risk Analysis, Decision Tree Analysis.

Text Books/References:

- James Evans, Business Analytics, 2e, Pearson.
- Camm, Cochran, Fry, Ohlmann, Anderson, Sweeney, Williams Essential of Business Analytics, Cengage Learning.

- Thomas Eri, Wajid Khattack & Paul Buhler: Big Data Fundamentals, Concepts, drivers and Techniques by Prentice Hall of India, New Delhi.
- Akil Maheswari: Big Data, Upskill ahead by Tata McGraw Hill, New Delhi.
- Seema Acharya & Subhashini Chellappan: Big Data and Analytics, Wiley Publications, New Delhi.
- S. Christian Albright, Wayne L. Winston: Business Analytics: Data Analysis & Decision Making, Cengage Learning

CourseOutcomes:

- Students will be able to understand Importance of Analytics.
- Students will be able to understand Understanding the analytical tools.
- Students will be able to understand Application of Analytical tools to solve business problems.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Analyze and evaluate appropriate business strategies, practices, and theories that inform and guide organizations to ensure sustainability.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year I Sem **L/P/C**
3/-/3

(R22DCS51) SCRIPTING LANGUAGES
(OPEN ELECTIVE -I)

Course Objectives:

- Motivation for and applications of scripting.
- Difference between scripting languages and non- scripting languages.
- Types of scripting languages.
- Scripting languages such as PERL, PHP,TCL/TK, python and BASH.
- Creation of programs in the Linux environment.

UNIT I

Introduction to PERL and Scripting Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines, advance per l - finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

UNIT II

PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT III

Advanced PHP Programming Php and Web Forms, Files, PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World – Translating Websites- Updating Web sites Scripts, Creating the Localization Repository, Translating Files, text, Generate Binary Files, Set the desired language within your scripts, Localizing Dates, Numbers and Times.

UNIT IV

TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and up level commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk- Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding, Perl-Tk.

UNIT V

Python Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling, Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

Course Outcomes:

- Ability to create and run scripts using PERL/TCl/Python/PHP in IC design flow.
- Be familiar with design issues of object-oriented and functional languages.
- Be familiar with language abstraction constructs of classes, interfaces, packages, and procedures.
- Be familiar with using functional languages.
- Ability to use Linux environment and write programs for automation of scripts in VLSI tool design flow.

TEXT BOOKS:

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. Python Web Programming, Steve Holden and David Beazley, New Riders Publications.
3. Beginning PHP and MySQL, 3rd Edition, Jason Gilmore, Apress Publications (Dreamtech)

REFERENCE BOOKS:

1. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education.
2. Programming Python, M.Lutz, SPD.
3. PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications.
4. PHP 5.1,I.Bayross and S.Shah, The X Team, SPD.
5. Core Python Programming, Chun, Pearson Education.
6. Guide to Programming with Python, M.Dawson, Cengage Learning.
7. Perl by Example, E.Quigley, Pearson Education.
8. Programming Perl, Larry Wall, T.Christiansen and J.Orwant, O'Reilly, SPD.
9. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
10. PHP and MySQL by Example, E.Quigley, Prentice Hall(Pearson).
11. Perl Power, J.P.Flynt, Cengage Learning.
12. PHP Programming solutions, V.Vaswani, TMH.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year I Sem **L/P/C**
3/-/3

(R22DAE51) MATHEMATICAL MODELING TECHNIQUES
(OPEN ELECTIVE -I)

Course Objectives

- The objective is to emphasize the importance of mathematical modeling of diverse engineering problems.
- Specifically aerospace problems will be discoursed to understand the need for numerical techniques
- To introduce optimization techniques into numerical problems to reduce problem data.
- Identify a problem and choose an appropriate mathematical model.
- Solve the problem using the appropriate technology if necessary.

UNIT-I

INTRODUCTION TO MODELING AND SINGULAR PERTURBATION METHODS: Definition of a model, Procedure of modeling: problem identification, model formulation, reduction, analysis, Computation, model validation, Choosing the model, Singular Perturbations: Elementary boundary layer theory, Matched asymptotic expansions, Inner layers, nonlinear oscillations

UNIT-II

VARIATIONAL PRINCIPLES AND RANDOM SYSTEMS: Variational calculus: Euler's equation, Integrals and missing variables, Constraints and Lagrange multipliers, Variational problems: Optics-Fermat's principle, Analytical mechanics: Hamilton's principle, Symmetry: Noether's theorem, Rigid body motion, Random systems: Random variables, Stochastic processes, Monte Carlo method

UNIT-III: **FINITE DIFFERENCES: ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS**

ODE: Numerical approximations, Runge-Kutta methods, Beyond Runge-Kutta, PDE: Hyperbolic equations-waves, Parabolic equations-diffusion, Elliptic equations-boundary values

CELLULAR AUTOMATA AND LATTICE GASES: Lattice gases and fluids, Cellular automata and computing

UNIT- IV

FUNCTION FITTING AND TRANSFORMS: Function fitting: Model estimation, Least squares, Linear least squares: Singular value decomposition, Non-linear least squares: Levenberg-Marquardt method, Estimation, Fisher information, and Cramer-Rao inequality, Transforms: Orthogonal transforms, Fourier transforms, Wavelets, Principal components

FUNCTION FITTING ARCHITECTURES: Polynomials: Pade approximants, Splines, Orthogonal functions, Radial basis functions, Over-fitting, Neural networks: Back propagation, Regularization

UNIT-V

OPTIMIZATION AND SEARCH: Multidimensional search, Local minima, Simulated annealing, Genetic algorithms

FILTERING AND STATE ESTIMATION: Matched filters, Wiener filters, Kalman filters, non-linearity and entrainment, Hidden Markov models

Course Outcomes:

- Student will be able to predict and develop a numerical framework to a problem of physical interest.
- Student will be able to choose different techniques to solve various problems of diverse engineering, more especially to aeronautics and aerospace.
- Student will also enable to choose better optimized solutions using different optimization techniques.
- Students will develop understanding of various mathematical concepts and modeling techniques required for successful application of mathematics.
- Student will be able to model data using the language and techniques of mathematics.

TEXT BOOK:

1. The Nature of Mathematical Modeling, Neil Gershenfeld, Cambridge University Press, 2006, ISBN 0-521-57095-6

REFERENCE BOOKS:

1. Mathematical Models in the Applied Sciences, A. C. Fowler, Cambridge University Press, 1997, ISBN 0-521-46140-5
2. A First Course in Mathematical Modeling, F. R. Giordano, M.D. Weir and W.P. Fox, 2003, Thomson, Brooks/Cole Publishers
3. Applied Numerical Modeling for Engineers, Donald De Cogan, Anne De Cogan, Oxford University Press, 1997

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year I Sem **L/P/C**
3/-/3

(R22DEC51) EMBEDDED SYSTEMS PROGRAMMING
(OPEN ELECTIVE -I)

Course Objectives

- To have knowledge about the basic programming of an embedded system.
- To provide in-depth knowledge about embedded processor, its hardware and software.
- To explain real time operating systems, inter-task communication and an embedded software development tool.
- To acquire knowledge about embedded processors and their applications.
- Test a real application of Embedded system on Board

UNIT-I

Embedded OS (Linux) Internals: Linux internals: Process Management, File Management, Memory Management, I/O Management. Overview of POSIX APIs, Threads – Creation, Cancellation, POSIX Threads Inter Process Communication - Semaphore, Pipes, FIFO, Shared Memory Kernel: Structure, Kernel Module Programming Schedulers and types of scheduling. Interfacing: Serial, Parallel Interrupt Handling Linux Device Drivers: Character, USB, Block & Network

UNIT-II

Open source RTOS: Basics of RTOS: Real-time concepts, Hard Real time and Soft Real-time, Differences between General Purpose OS & RTOS, Basic architecture of an RTOS, Scheduling Systems, Inter-process communication, Performance Matric in scheduling models, Interrupt management in RTOS environment, Memory management, File systems, I/O Systems, Advantage and disadvantage of RTOS.

UNIT-III

Open Source RTOS Issues: POSIX standards, RTOS Issues - Selecting a Real Time Operating System, RTOS comparative study. Converting a normal Linux kernel to real time kernel, Xenomai basics. Overview of Open source RTOS for Embedded systems (Free RTOS/ Chibios-RT) and application development.

UNIT-IV

VxWorks / Free RTOS: VxWorks/ Free RTOS Scheduling and Task Management - Realtime scheduling, Task Creation, Inter task Communication, Pipes, Semaphore, Message Queue, Signals, Sockets, Interrupts I/O Systems - General Architecture, Device Driver Studies, Driver Module explanation, Implementation of Device Driver for a peripheral

UNIT-V

Case study: Cross compilers, debugging Techniques, Creation of binaries & porting stages for Embedded Development board (Beagle Bone Black, Rpi or similar), Porting an Embedded OS/ RTOS to a target board (). Testing a real time application on the board

Course Outcomes

- Ability to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
- Ability to port an Embedded OS/ RTOS to a target board.
- Foster ability to understand the design concept of embedded systems.
- Ability to integrate hardware and software for embedded applications systems.
- Foster ability to understand the design concept of embedded systems.

TEXT BOOKS:

1. Essential Linux Device Drivers, Venkateswaran Sreekrishnan
2. Writing Linux Device Drivers: A Guide with Exercises, J. Cooperstein
3. Real Time Concepts for Embedded Systems – Qing Li, Elsevier

REFERENCES:

1. Embedded Systems Architecture Programming and Design: Raj Kamal, Tata McGraw Hill
2. Embedded/Real Time Systems Concepts, Design and Programming Black Book, Prasad, KVK
3. Software Design for Real-Time Systems: Cooling, J E Proceedings of 17the IEEE Real-Time Systems Symposium December 4-6, 1996 Washington, DC: IEEE Computer Society
4. Real-time Systems – Jane Liu, PH 2000
5. Real-Time Systems Design and Analysis : An Engineer's Handbook: Laplante, Phillip A
6. Structured Development for Real - Time Systems V1 : Introduction and Tools: Ward, Paul T & Mellor, Stephen J
7. Structured Development for Real - Time Systems V2 : Essential Modeling Techniques: Ward, Paul T & Mellor, Stephen J
8. Structured Development for Real - Time Systems V3 : Implementation Modeling Techniques: Ward, Paul T & Mellor, Stephen J
9. Monitoring and Debugging of Distributed Real-Time Systems: TSAI, Jeffrey J P & Yang, J H
10. Embedded Software Primer: Simon, David E.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

II Year M.Tech MD- I Sem **L/P/C**

-/-/8

(R22D1585) DISSERTATION PHASE 1

DISSERTATION PHASE 1

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study.

The dissertation should have the following

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

II YEAR

II SEMESTER

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year II Sem **L/P/C**

-/-/14

(R22D1586) DISSERTATION PHASE 2

Course Objectives:

- Student understand the project and should give the clear explanation about the project
- To provide the foundation of good programming skills by discussing key issues to the design of project.
- To be able to apply some of the techniques/principles students have been taught.
- To enable the students to attend placements and be better performers in their future.
- To familiarize with the various techniques.

Course Outcomes:

- Understand the data requirements and collect data relevant to their research.
- Analyze data and interpret results.
- Develop research design for their topic of research.
- Follow the process related activity and testing techniques to work as team member.
- Implement different system calls for various file handling operations.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech MD II Year II Sem **L/P/C**

-/-/14

(R22D1587) DISSERTATION PROJECT VIVA VOCE

Course Objectives:

- Student understand the project and should give the clear explanation about the project
- To provide the foundation of good programming skills by discussing key issues to the design of project.
- To be able to apply some of the techniques/principles students have been taught.
- To enable the students to attend placements and be better performers in their future.
- To familiarize with the various techniques

Course Outcomes:

- Understand the data requirements and collect data relevant to their research.
- Analyze data and interpret results.
- Develop research design for their topic of research.
- Follow the process related activity and testing techniques to work as team member.
- Implement different system calls for various file handling operations.