DEPARTMENT OF MECHANICAL ENGINEERING

Scheme of Instruction and Syllabi
of
M.E. (Mechanical)

Specialization:
ADVANCED DESIGN AND MANUFACTURING

Full time / Part time

(2012-13)

UNIVERSITY COLLEGE OF ENGINEERING
(Autonomous)
Osmania University
Hyderabad – 500 007, A.P., INDIA
**Scheme of Instruction & Examination**
M.E. (Mechanical Engineering) 4 Semesters (Full Time)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Subject</th>
<th>Periods per week</th>
<th>Duration (Hrs)</th>
<th>Max. Marks</th>
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**Semester - II**

|        |                          | L/T              | D/P            | 3          | 80        | 20        | 20        |
|        |                          | 3                | --             | 3          | 80        | 20        | 20        |
|        |                          | 3                | --             | 3          | 80        | 20        | 20        |
|        | Core / Elective          | 3                | --             | 3          | 80        | 20        | 20        |
|        | Core / Elective          | 3                | --             | 3          | 80        | 20        | 20        |
|        | Elective                 | 3                | --             | 3          | 80        | 20        | 20        |
|        | Laboratory - II          | --               | 3              | --         | --        | 50        |
|        | Seminar - II             | --               | 3              | --         | --        | 50        |
|        | Total                    | 18               | 6              |            | 480       | 220       |

**Semester - III**

|        | Project Seminar*         | --               | 6              | --         | --        | 100**     |

**Semester - IV**

|        | Dissertation             | --               | --             | --         | Viva - Voce (Grade ***)| -- |

Note: Six core subjects, Six elective subjects, Two Laboratory Courses and Two Seminars should normally be completed by the end of semester II.

* Project seminar presentation on the topic of Dissertation only
** 50 marks awarded by the project guide and 50 marks by the internal committee.
*** Excellent/Very Good/Good/Satisfactory/Unsatisfactory
### Scheme of Instruction & Examination
M.E. (Mechanical Engineering) 6 Semesters (Part Time)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Subject</th>
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<th>Duration (Hrs)</th>
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Note: Six core subjects, Six elective subjects, Two Laboratory Courses and Two Seminars should normally be completed by the end of semester IV.

* Project seminar presentation on the topic of Dissertation only
** 50 marks awarded by the project guide and 50 marks by the internal committee.
*** Excellent/Very Good/Good/Satisfactory/Unsatisfactory
With effect from the academic year 2012 – 2013

Scheme of Instruction & Examination Post Graduate Course in Mechanical Engineering with specialization in **Advanced Design and Manufacturing**.

Course duration: 4 semesters (full-time), 6 Semesters (part-time)

<table>
<thead>
<tr>
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<th>Subject</th>
<th>Scheme of Instruction</th>
<th>Scheme of Examination</th>
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<td>1</td>
<td>ME 507</td>
<td>Robotic Engineering</td>
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<td>ME 502</td>
<td>Metallurgy of Metal Casting and Welding</td>
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<td>3</td>
<td>ME 532</td>
<td>Computer Aided Mechanical Design and Analysis</td>
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<td>Metal Cutting &amp; Forming</td>
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<td>Computer Integrated Design and Manufacture</td>
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<td>ME 522</td>
<td>Flexible Manufacturing Systems</td>
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**ELECTIVES**

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<td>Finite Element Techniques</td>
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<td>Neural Networks and Fuzzy Logic</td>
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<td>Product Design and Process Planning</td>
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<td>Mechatronics and Its Applications</td>
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<td>Advanced Non-Destructive Evaluation Techniques</td>
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<td>Rapid prototyping, Tooling &amp; Manufacturing</td>
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<td>ME 575</td>
<td>Creative Engineering Design</td>
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<td>ME 521</td>
<td>Engineering Research Methodology</td>
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**DEPARTMENTAL REQUIREMENTS**

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<td>CAD/CAM Lab (Lab I)</td>
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*Excellent / Very Good / Good / Satisfactory / Unsatisfactory*
ME 507

ROBOTIC ENGINEERING

Instruction 3 Periods/week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Brief History, Types of robots, Overview of robot subsystems, resolution, repeatability and accuracy, Degrees of freedom of robots, Robot configurations and concept of workspace, Mechanisms and transmission, End effectors and Different types of grippers, vacuum and other methods of gripping. Pneumatic, hydraulic and electrical actuators, applications of robots, specifications of different industrial robots.

UNIT-II
Rotation matrices, Euler angle and RPY representation, Homogeneous transformation matrices, Denavit-Hartenberg notation, representation of absolute position and orientation in terms of joint parameters, direct kinematics.

UNIT-III
Inverse Kinematics, inverse orientation, inverse locations, Singularities, Jacobian, Trajectory Planning: joint interpolation, task space interpolation, executing user specified tasks, sensor based motion planning: The Bug Algorithm, The Tangent Bug Algorithm, The Incremental Voronoi Graph.

UNIT-IV
Static force analysis of RP type and RR type planar robots, Dynamic analysis using Lagrangean and Newton-Euler formulations of RR and RP type planar robots, Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, force feedback, hybrid control.

UNIT-V
Sensors and controllers: Internal and external sensors, position, velocity and acceleration sensors, proximity sensors, force sensors, laser range finder. Robot vision: image processing fundamentals for robotic applications, image acquisition and preprocessing. Segmentation and region characterization object recognition by image matching and based on features

Suggested Reading:

With effect from the academic year 2012 – 2013

ME 502

METALLURGY OF METAL CASTING AND WELDING

Instruction
Duration of University Examination
University Examination
Sessional

3 Periods /Week
3 Hrs
80 Marks
20 Marks

UNIT-I
Metallurgy of Cast Steel and Cast Iron: Solidification microstructure, effect of cooling rate, carbon content, malleable and ductile Cast Iron.

Solidification of Castings: Solidification of pure metals and alloys, solidification rate and directional solidification, grain structure of cast metals, shrinkage, gases in cast metals, degassification.


UNIT-II

Zinc based die casting alloys, Nickel chromium high temperature alloys, Foundry practices of copper, aluminium and magnesium base alloys.

UNIT-III

UNIT-IV

UNIT-V
Weldability aspects of low alloy steels, stainess steels, aluminium alloys, Magnesium and Titanium alloys.
Weld cracks – cold and hot cracks; Liquation cracks, Hydrogen Induced cracks, Lamellar cracks.

Suggested Reading:
### COMPUTER AIDED MECHANICAL DESIGN AND ANALYSIS

<table>
<thead>
<tr>
<th>Instruction</th>
<th>3 Periods /Week</th>
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<tr>
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<td>3 Hrs</td>
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<td>80 Marks</td>
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<td>Sessional</td>
<td>20 Marks</td>
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**UNIT-I**
Design of pressure Vessels: Introduction and constructional features of pressure vessels, stresses in pressure vessels, shrink fit stresses in built up cylinders, autofrettage of thick cylinders, thermal stresses and their significance.

**UNIT-II**
Stresses in flat plates: Introduction, Bending of plate in one direction, Bending of plate in two perpendicular directions, Thermal stresses in plates, Bending of circular plates of constant thickness, Bending of uniformly loaded plates of constant thickness.

**UNIT-III**

**UNIT-IV**
Eigen Value Problems: Properties of Eigen values and Eigen Vectors, Torsional, Longitudinal vibration, lateral vibration, Sturm sequence. Subspace iteration and Lanczo’s method, Component mode synthesis, Eigen value problems applied to stepped beams and bars.

**UNIT-V**

(Note: The related algorithms and codes to be practiced by students)

**Suggested Reading:**

ME 564

METAL CUTTING & FORMING

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Tool Materials: Tool material properties – HSS, Carbides, coated carbides, ceramic and CBN and diamonds, sialons, powder coatings – Relative advantages.
Estimation of shear angle experimentally. Metal cutting friction. Real area of contact-Rules of dry sliding, stress distribution of tool face-variation of co-efficient of tool face friction with the rake angle.

UNIT-II

UNIT-III
Recent development in metal cutting: Hot machining. Rotary machining – High speed machining, rapid proto typing.

UNIT-IV

UNIT-V

Suggested Reading:
ME 568

COMPUTER INTEGRATED DESIGN & MANUFACTURE

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II
Advanced Manufacturing Technology – Design drafting interface, Graphic libraries, Computer aided manufacturing technologies using Numerical Control, CNC and DNC, process interface hardware, programming languages, direct digital control, supervisory compiler controls and optical control, adoptive control – Agile and lean manufacturing.

UNIT-III

UNIT-IV
Concepts of Production Planning, Material Requirement Planning, up to down planning and bottom up replanning – Master production scheduling, PPC, Material Handling Requirements, Technology Planning.

UNIT-V
Communication aspects in CIM – Issues in Implementation of Advanced Manufacturing Technology – configuration management, database systems, networking concepts, LAN, MAN, SQL, CIM Models, Economics of CIM.

Suggested Reading:
FLEXIBLE MANUFACTURING SYSTEMS

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Systems Planning: Objective, introduction planning, preparation guidelines, the project team, supplier selection, system description and sizing, facility preparation planning, FMS layouts. Human resources: staff considerations, team work, communication and involvement, the supervisors role, personnel selection, job classifications, employee training.

UNIT-II
Group Technology: Concepts, classification and coding, benefits and relationship to FMS, design of group technology using rank order clustering technique.

UNIT-III
FMS Design – Using Bottleneck, Extended bottleneck models, Processing and Quality Assurance: Turning centres, Machining centre, construction and operations performed, axes, programming, and format information, work-holding and work-changing equipment, automated features and capabilities, cleaning and deburring – station types and operation description, importance to automated manufacturing, coordinate measuring machines, types, construction and general function, operation cycle description, importance to flexible cells and systems.

UNIT-IV
Automated movement and storage systems–AGVs, Robots, automated storage and retrieval systems, storage space design, queuing carousels and automatic work changers, coolant and chip Disposal and recovery systems, auxiliary support equipment, cutting tools and tool Management – introduction, getting control of cutting tools, Tool Management, tool strategies, data transfer, tool monitoring and fault detection, guidelines, work holding considerations, General fixturing, Modular fixturing. FMS and the relationship with workstations – Manual, automated and transfer lines design aspects.

UNIT-V
FMS: computer Hardware, Software, Communications networks and Nanotechnology – general functions, and manufacturing usages, hardware configuration, programmable logic controllers, cell controllers, communications networks. FMS implementation.

Suggested Reading:
ME 530

ADVANCED KINEMATICS

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Kinematic Analysis of plane mechanism: Analytical method of kinematic analysis of four bar mechanism. Acceleration analysis of complex mechanisms by auxiliary point method, good man’s indirect method.

UNIT-II
Kinematic synthesis of linkages: Number synthesis, associated linkage or equivalent linkage concept, dimensional synthesis by analytical and graphical methods.

UNIT-III
Kinematic analysis of four link RGGR spatial mechanism, D-H parameters, Transformations matrix method for position velocity and acceleration analysis of special mechanisms.

UNIT-IV
Cams: Analysis of follower motions, analytical cam design.

UNIT-V
Kinematic analysis of two-degree freedom of Robot arm.

Suggested Readings:
ME 508

FINITE ELEMENT TECHNIQUES

Instruction  3 Periods /Week
Duration of University Examination  3 Hrs
University Examination  80 Marks
Sessional  20 Marks

UNIT-I
Introduction to Finite Element Method of solving field problems. Stress and Equilibrium. Boundary
conditions. Strain-Displacement relations. Stress-strain relations.
One Dimensional Problem: Finite element modeling. Local, natural and global coordinates and shape
element equations, treatment of boundary conditions. Quadratic shape functions.

UNIT-II
Analysis of trusses and frames: Analysis of plane truss with number of unknowns not exceeding two at
each node. Analysis of frames with two translations and a rotational degree of freedom at each node.
Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node for beam
element.

UNIT-III
Finite element modeling of two dimensional stress analysis problems with constant strain triangles and
treatment of boundary conditions. Two dimensional four noded isoparametric elements and numerical
integration. Finite element modeling of Axisymmetric solids subjected of axisymmetric loading with
triangular elements.
Convergence requirements and geometric isotropy.

UNIT-IV
Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional conduction
analysis of thin plate.
Time dependent field problems: Application to one dimensional heat flow in a rod.
Dynamic analysis: Formulation of finite element modeling of Eigen value problem for a stepped bar and
beam. Evaluation of Eigen values and Eigen vectors.
Analysis of a uniform shaft subjected to torsion using Finite Element Analysis.

UNIT-V
Finite element formulation of three dimensional problems in stress analysis.
Finite Element formulation of an incompressible fluid. Potential flow problems
Bending of elastic plates. Introduction to non-linear problems and Finite Element analysis software.

Suggested Reading:
1. Tirupathi R Chandraputla and Ashok. D. Belegundu, Introduction of Finite Element in Engineering,
With effect from the academic year 2012 - 2013

**ME 511**

**OPTIMISATION TECHNIQUES**

**Instruction**  
3 Periods/week

**Duration of University Examination**  
3 Hrs

**University Examination**  
80 Marks

**Sessional**  
20 Marks

**UNIT – I**

**Simulation:** Introduction, Types of Simulation, Simulation Models, Monte Carlo Simulation, Random Number, Pseudo Random Number, Mid-Square Method of generating Random Numbers, Application & Limitation, Application of Simulation to Inventory Control and Queuing Problem

**UNIT – II**

**Decision Theory:** Introduction, Decision, Decision Making & Decision Theory, Types of Decisions, decision making process, Types of Decision making Environment:

- Decision making under certainty – Expected Monetary Value (EMV), Expected Opportunity Loss (EOL) Criterion & Expected Value of Perfect Information (EVPI) Criterion
- Decision making under risk - Criterion of Pessimism or Manimax, Criterion of Optimism or Maximin, Minimax Regret Criterion, Criterion of Realism & Criterion of Rationality
- Decision making under uncertainty and Decision tree analysis: Introduction, Procedure of Constructing Decision Trees & Solution through Decision Tree Analysis.

**UNIT – III**

**Integer Programming:** Introduction, Types of Integer Programming Problems, Gomory’s Cutting Plane method. Branch and Bound method for all Integer Programming Problems & Mixed Integer Programming Problems

**UNIT – IV**

**Dynamic Programming:** Introduction- Bellman’s principle of optimality-Application of dynamic programming-Linear programming problem-Capital budgeting problem

**UNIT – V**

**Classical Optimization:** Introduction; Unconstrained problems of maxima and minima, constrained problems of maxima and minima; Constraints in the form of equations – Lagrangian method; Constraints in the form of inequalities -Kuhn-tucker conditions.

**Suggested Reading:**

ME 534

VIBRATION ANALYSIS AND CONDITION MONITORING

Instruction
Duration of University Examination
University Examination
Sessional

3 Periods /Week
3 Hrs
80 Marks
20 Marks

UNIT-I
Causes and effects of vibration. Vibrations of Single Degree, Two Degree and Multi Degree of freedom systems. Steady state and transient characteristics of vibration.

UNIT-II
Introduction to Condition Monitoring, Failure types, investigation and occurrences. Causes of failure, Characteristics of vibration – SHM, Periodic motion, Displacement, Velocity and acceleration. Peak to peak & RMS, linear and logarithmic scales and phase angle.

UNIT-III

UNIT-IV
Condition Monitoring through vibration analysis. Frequency analysis, Filters, Vibration signature of active systems, vibration limits and standards. Contaminant analysis, SOAP and other contaminant monitoring techniques.

UNIT-V
Special vibration measuring techniques - Change in sound method, Ultrasonic measurement method, Shock pulse measurement, Kurtosis, Acoustic emission monitoring, Cepstrum analysis, Modal analysis, critical speed analysis, Shaft –orbit & position analysis.

Suggested Reading:

4. Pox and Zenkins, Time Series Analysis.
With effect from the academic year 2012 - 2013

ME 512

NEURAL NETWORKS AND FUZZY LOGIC

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Concepts of fuzzy sets: Introduction – Crisps sets, notation of fuzzy sets, basic concepts of fuzzy sets, operation, fuzzy compliment, union, intersection, Binary relation, Equivalence and similarity relations, belief and plausibility measures, probability measures, computability, relations, ordering morphisms, possibility and necessary measures.

UNIT-II
Adaptive fuzzy systems: Neural and Fuzzy intelligence, Fuzziness as multivalent, fuzziness in probabilistic world, randomness verses ambiguity.

UNIT-III

UNIT-IV
Introduction to Neural networks: Knowledge base information processing, general view of knowledge based algorithm, neural information processing, Hybrid intelligence, and artificial neurons.

UNIT-V

Suggested Reading:

ME 514

MECHANICS OF COMPOSITE MATERIALS

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II
Micromechanics of Composites:
Mechanical properties: Prediction of Elastic constant, micromechanical approach, Halpin-Tsai equations, Transverse stresses.
Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

UNIT-III
Macromechanics of Composites:
Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, inter-laminar stresses and edge effects. Simplified composite beam solutions. Bending of laminated beams.

UNIT-IV
Strength, fracture, fatigue and design:
Tensile and compressive strength of unidirectional fibre composites, fracture modes in composites: Single and multiple fracture, de-bonding, fibre pullout and de-lamination failure, fatigue of laminate composites. Effect of variability of fibre strength.
Strength of an orthotropic lamina: Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials.

UNIT-V
Analysis of plates and stress:
Plate equilibrium equations, Bending of composite plates, Levy and Navier solution for plates of composite materials. Analysis of composite cylindrical shells under axially symmetric loads.

Suggested Reading:
ME 516

THEORY OF ELASTICITY AND PLASTICITY

Instruction 3 Periods/week
Duration of University Examination 3 Hrs.
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Basic Concepts of Stress: Definition, State of Stress at a point, Stress tensor, invariants of stress tensor, principle stresses, stress ellipsoid, derivation for maximum shear stress and planes of maximum shear stress, octahedral shear stress, Deviatoric and Hydrostatic components of stress, Invariance of Deviatoric stress tensor, plane stress.

UNIT-II
Basic concepts of Strain: Deformation tensor, Strain tensor and rotation tensor; invariants of strain tensor, principle strains, derivation for maximum shear strain and planes of maximum shear strain, octahedral shear strain, Deviatoric and Hydrostatic components of strain tensor, Invariance of Deviatoric strain tensor, plane strain.

UNIT-III
Generalized Hooke’s Law: Stress-strain relationships for an isotropic body for three dimensional stress space, for plane stress and plane strain conditions, differential equations of equilibrium, compatibility equations, Material (D) matrix for Orthotropic Materials.

UNIT-IV

UNIT-V
Analysis methods: Slab method, Slip line field method, uniform deformation energy method, upper and lower bound solutions. Application of Slab method to forging, wire drawing, extrusion and rolling processes.

Suggested Reading:
1. Timoshenko and Goodieer, Theory of Elasticity, Mcgraw Hill Publications 3rd Edition,
2. Madleson, Theory of Plasticity,
ME 517

EXPERIMENTAL TECHNIQUES AND DATA ANALYSIS

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II
Temperature Measurement: Circuits and instrumentation for different transducers viz, bimetallic, expanding fluid, electrical resistance, thermister, thermocouples, pyrometers.

UNIT-III
Metallurgical Studies: Optical and electron microscopy, X-Ray diffraction, Bragg’s Law and its application for studying crystal structure and residual stresses. Electron spectroscopy, electron microprobe.
Surface Measurements: Micro hardness, roughness, accuracy of dimensions and forms. 3-D co-ordinate measuring machines.

UNIT-IV
Experiment design & data analysis: Statistical methods, Randomised block design, Latin and orthogonal squares, factorial design. Replication and randomization.
Data Analysis: Deterministic and random data, uncertainty analysis, tests for significance: Chi-square, student’s ‘t’ test. Regression modeling, direct and interaction effects. ANOVA, F-test. Time Series analysis, Autocorrelation and autoregressive modeling.

UNIT-V

Suggested Reading:

4. Box and Jenkins; Time Series analysis, Forecasting and control, Holden Day, Sanfrancisco.
ME 519

PRODUCT DESIGN AND PROCESS PLANNING

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

Unit-I

Unit-II

Unit-III

Unit-IV

UNIT-V
Role of computer in product design and management of manufacturing, creation of manufacturing data base, Computer Integrated Manufacturing, communication network, production flow analysis, Group Technology, Computer Aided product design and process Planning. Integrating product design, manufacture and production control.

Suggested Reading:
With effect from the academic year 2012 - 2013

ME 569

MECHATRONICS AND ITS APPLICATIONS

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Introduction to Mechatronics: Concepts of system integration- Mechanical systems with electronic actuation, sensing, Monitoring and control – Applications of Mechatronics in Mechanical industries.

UNIT-II

UNIT-III
Digital circuits and systems: Digital representation, combinational logic gates – timing diagrams – Boolean expressions and truth tables – sequential logic.

UNIT-IV
Data Analysis tools- MATLAB and LABVIEW software-features and capabilities of the software. Applications to machine control, Robotics and Engines.

UNIT-V

Suggested Reading:

ME 570

QUALITY & RELIABILITY ENGINEERING

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II
Loss Function, Tolerance Design – N Type, L Type, S Type; determination of tolerance for these types, nonlinear tolerances. Online Quality Control – Variable Characteristics, Attribute Characteristics, Parameter Design.

UNIT-III

UNIT-IV

UNIT-V
Maintainability, Availability, Economics of Reliability Engineering; Replacement of items, Maintenance Costing and Budgeting, Reliability Testing – Burn in testing by binomial, exponential models, Accelerated life testing.

Suggested Reading:

ME 571

VALUE ENGINEERING

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Basic concepts of Value Engineering – Function, Value, Value analysis, Value of job plan, Study of Engineering materials specially latest materials with respect to their mechanical properties, Cost and availability. Study of wide range of manufacturing processes based on the factors – productivity, time, cost, surface finish, tolerance etc.

UNIT-II

UNIT-III
Productivity, improvement by Value Engineering and Value analysis – Selection of Engineering Products of different applications and studying each one of them about design, types of stresses induced, manufacturing method.

UNIT-IV
Results acceleration – Basic steps, valuation of Value Engineering, Problem setting, Problem solving case studies alternative methods and best possible method.

UNIT-V
Work study and Value Engineering Methods: Case studies in work study and Value Engineering methods – product Design implementation using Value Engineering. Developing any one product (important in functional aspect) which actually adds Value to Existing product in use.

Suggested Reading:
ME 572

ADVANCED NON-DESTRUCTIVE EVALUATION TECHNIQUES

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Types of defects and characteristics, Quantification aspects relevant for NDE including fracture aspects and stress intensity factors - NDT overview – quality assurance–visual inspection–comparative features of conventional Nondestructive Testing and Evaluation Methods including Optical, Radiography, Ultrasonic Testing, Dye penetrant testing, Eddy current testing etc.

UNIT-II

UNIT-III
Infrared and thermal testing – imaging systems – detectors – analysis methods.
Ultrasonic testing – generation of ultrasound – methodologies – transducers and equipment used – flaw detection - sensitivity and calibration.

UNIT-IV
Computer aided image processing methods for radiography and ultrasonics, tomography in these areas.
Optical techniques of nondestructive evaluation: Principles of Photoelasticity, holographic Interferometry and Laser speckle techniques; use of fibre optics, noninvasive techniques in medical field and NDT.

UNIT-V
Grid and Moire NDT, acoustic, ultrasonic and shearography, Principles of Microwave, acoustic emission techniques and Infrared thermography.

Suggested Reading:
MEMS AND NANO-TECHNOLOGY

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II

UNIT-III
Application of Sensors & Actuators – Mechanical – MEMS Devices (Cantilevers, anemometers, pressure transducers and micro pumps) – RF, Electrical and Magnetic MEMS – Bio-MEMS.

UNIT-IV

UNIT-V
Technology to make components like Computer Hardware, Optical Systems, Fibre Optics & Allied components, Micro Injection Moulding and Nano Technology

Suggested Reading:

ME 557

DESIGN FOR MANUFACTURE

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Introduction: General design principles for manufacturability, strength and mechanical factors, mechanisms selection, evaluation method, geometrical tolerances, tolerance control and utilization.

Economic Use of Raw Materials: Ferrous steel, hot rolled steel, cold finished steel, stainless steel, non ferrous materials aluminium, copper, brass, non metallic materials, plastics, rubber and composites.

UNIT-II
Metallic Components Design: Metal extrusion, metal stamping, fine blanking, four slide parts, spring and wire forms, spun metal parts, cold headed parts, extruded parts, tube and section bends, rolled formed parts, power metal parts, forging electro forming parts, specialized forming methods, turned parts, machined round holes, drilled parts, milled parts.

UNIT-III
Metallic Components Design: Planned shaped and slotted parts, screw threaded contoured and internal ground parts, center less ground, electrical discharged, rolled furnished parts, electro chemical and advanced machine parts. Sand cast, die cast, investment cast and other cast products.

UNIT-IV
Non Metallic Components Design: Thermosetting plastic, injection moulded and rotational moulded parts, blow moulded, welded plastic articles, ceramics.

Assembled Parts Design: Welded parts, arc, resistance, brazed and soldered parts, gear box assembly, bearing assembly.

UNIT-V
Assembled Parts Design: Retension, bolted connection, screwed connections, flanged connections, centred connections, press fitted connections, surface finishing, plated parts, heat treated parts, NC machining, group technology, low cost automation, computer aided manufacture, product design requirements.

Case Studies: Identification of economical design and redesign for manufacture.

Suggested Reading:
FRACTURE MECHANICS

Instruction - 3 periods/week
Duration of University Examination - 3 Hours
University Examination - 80 Marks
Sessional - 20 Marks

UNIT-I

UNIT-II

UNIT-III

Fatigue Crack Growth: Fatigue crack growth test, stress intensity factor, factors affecting stress intensity factor – Variable amplitude service loading, retardation model.

UNIT-IV

UNIT-V

Suggested Reading:
ME 520

RAPID PROTOTYPING PRINCIPLES AND APPLICATIONS

Instruction 3 Periods/Week
Duration of University Examination 3 hours
University Examination 80 Marks
Sessional 20 Marks

UNIT – I

UNIT – II


UNIT – III


UNIT – IV

Rapid Prototyping Software’s: Features of various RP software’s like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT – V

Suggested Reading:
CREATIVE ENGINEERING DESIGN

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II

UNIT-III

UNIT-IV
Economics cost and planning: Mathematics of time value of money – Cost comparison – Profitability – Sensitivity and break even analysis – Benefit/Cost analysis – Cost estimates – Factor methods of cost estimation – Life cycle casting planning and scheduling – CPM and PERT.


UNIT-V


Suggested Reading:
ME/Ph.D 521

ENGINEERING RESEARCH METHODOLOGY

Instruction: 3 Periods/week
Duration of University Examination: 3 Hrs.
University Examination: 80 Marks
Sessional: 20 Marks

UNIT-I
Defining the Research Problem: Definition of Research Problem, Problem Formulation, Necessity of Defining the Problem, Technique involved in Defining a Problem.

UNIT-II
Literature Survey: Importance of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT-III

UNIT-IV
Data Analysis: Deterministic and random data, Uncertainty analysis, Tests for significance: Chi-square, student’s t test, Regression modeling, Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Autocorrelation and Autoregressive modeling.

UNIT-V

Suggested Reading:

1. C.R Kothari, Research Methodology, Methods & Technique; New Age International Publishers, 2004
4. Vijay Upagade and Aravind Shende, Research Methodology, S. Chand & Company Ltd., New Delhi, 2009
With effect from the academic year 2012 - 2013

ME 562

CAD/CAM LABORATORY

Instruction 3 periods/week
Sessional 50 Marks

List of Exercises:

CAD

1. Understanding of various CAD commands and creating simple objects
2. Understanding of holes, cuts and model tree relations
3. Creation shafts, rounds, chamfers and slots
4. Sketch Tools & Datum planes
5. Creation of objects by revolved features, patterns and copies, sweeps and blends
6. Creation of engineering drawing details such as dimensioning, sectional views, adding esthetics
7. Assembling of part models using constraints
8. Assembly operations - part modifications, adding another assembly features – display.

CAM

1. Understanding of CNC Machines and CNC Programming and Creation of 2-D contour Pockets, Slots
2. Drills and Facing, 2-D high Speed blend
3. Surface Roughing for Bottle die
4. Surface finishing for Phone die
5. Manufacturing of Crane Hook
6. Manufacturing of Connecting Rod
7. Manufacturing of Turbine Blade
8. 3-D Machining using ball nose cutters
ME 536

AUTOMATION AND ROBOTICS LABORATORY

Instruction 3 periods/week
Sessional 50 Marks

List of Experiments

I MAT LAB

1. Basic syntax and command-line exercises
2. Basic array exercises
3. Relational and logical operations
4. Control of flow: if-blocks
5. Loop constructs: for and while
6. Basic 2D & 3D Plots
7. Solving ordinary differential equations
8. Curve fitting and interpolation
9. Data Analysis and statistics
10. Solving non-linear algebraic equations
11. Introduction to optimization methods like GA, Fuzzy, Neural & PSO
12. Introduction to SIMULINK
13. Modeling of problems related to design of robot using MATLAB

II SIMULATION SOFTWARE

14. Hydraulic equipment simulation using H-Simulator
15. Pneumatic equipment simulation using P-Simulator
16. PLC simulator

III ROBOTICS

17. Study of Articulated Robot
18. Introduction to various Robotic Programming Languages
19. Modeling and analysis of serial manipulators using Softwares like Robotworks, RoboKinematics and Robo cammotion