DEPARTMENT OF
MECHANICAL ENGINEERING

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

Specialization:
AUTOMATION & ROBOTICS

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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<td>L/T D/P</td>
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<td>Viva - Voce (Grade ***)</td>
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</table>

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)

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<th>Sessionals</th>
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<td><strong>3</strong></td>
<td><strong>240</strong></td>
<td><strong>110</strong></td>
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</table>

| Semester - II    |                          |                  |                |            |            |            |
| 1.       | Core                     | 3                | 3              | 80         | 20         |            |
| 2.       | Core / Elective          | 3                | 3              | 80         | 20         |            |
| 3.       | Elective                 | 3                | 3              | 80         | 20         |            |
| 4.       | Lab. I / Seminar - I     | --               | 3              | --         | 50         |            |
| Total    |                          | **9**            | **3**          | **240**    | **110**    |            |

| Semester - III   |                          |                  |                |            |            |            |
| 1.       | Core                     | 3                | 3              | 80         | 20         |            |
| 2.       | Core / Elective          | 3                | 3              | 80         | 20         |            |
| 3.       | Elective                 | 3                | 3              | 80         | 20         |            |
| 4.       | Lab. II / Seminar - II   | --               | 3              | --         | 50         |            |
| Total    |                          | **9**            | **3**          | **240**    | **110**    |            |

| Semester - IV    |                          |                  |                |            |            |            |
| 1.       | Core                     | 3                | 3              | 80         | 20         |            |
| 2.       | Core / Elective          | 3                | 3              | 80         | 20         |            |
| 3.       | Elective                 | 3                | 3              | 80         | 20         |            |
| 4.       | Lab. II / Seminar - II   | --               | 3              | --         | 50         |            |
| Total    |                          | **9**            | **3**          | **240**    | **110**    |            |

| Semester - V     |                          |                  |                |            |            |            |
| 1.       | Project Seminar*         | --               | 6              | --         | --         | 100**      |

| Semester - VI    |                          |                  |                |            |            |            |
| 1.       | 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 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 of Post Graduate course in Mechanical Engineering with specialization in **Automation & Robotics**

Course duration: 4 Semesters (Full Time), 6 semesters (Part – Time)

<table>
<thead>
<tr>
<th>Sl. No</th>
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<th>Subject</th>
<th>Scheme of Instruction</th>
<th>Scheme of Examination</th>
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<tr>
<td>1.</td>
<td>ME 501</td>
<td>Automation</td>
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<tr>
<td>2.</td>
<td>ME 529</td>
<td>Control of Dynamic System</td>
<td>3 --</td>
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<tr>
<td>3.</td>
<td>ME 507</td>
<td>Robotics Engineering</td>
<td>3 --</td>
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<td>4.</td>
<td>ME 530</td>
<td>Advanced Kinematics</td>
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<td>5.</td>
<td>ME 531</td>
<td>Fluid Power System</td>
<td>3 --</td>
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<td>6.</td>
<td>ME 532</td>
<td>Computer Aided Mechanical Design and Analysis</td>
<td>3 --</td>
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</table>

**CORE SUBJECTS**

<table>
<thead>
<tr>
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<th>Scheme of Examination</th>
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<tbody>
<tr>
<td>1.</td>
<td>ME 533</td>
<td>Microcontrollers and Applications</td>
<td>3 --</td>
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<tr>
<td>2.</td>
<td>ME 508</td>
<td>Finite Element Techniques</td>
<td>3 --</td>
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<tr>
<td>3.</td>
<td>ME 509</td>
<td>Programming Methodology and Data Structures</td>
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<td>4.</td>
<td>ME 510</td>
<td>Computer Aided Modeling and Design</td>
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<td>5.</td>
<td>ME 511</td>
<td>Optimization Techniques</td>
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<td>ME 534</td>
<td>Vibrations Analysis and Condition Monitoring</td>
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**ELECTIVES**

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<td>Under Actuated Robotics</td>
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<td>8.</td>
<td>ME 512</td>
<td>Neural Networks and Fuzzy Logic</td>
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<td>9.</td>
<td>ME 513</td>
<td>Artificial Intelligence and Expert Systems</td>
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<td>10.</td>
<td>ME 514</td>
<td>Mechanics of Composite Materials</td>
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<td>ME 505</td>
<td>Computer Integrated Manufacturing</td>
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<tr>
<td>12.</td>
<td>ME 517</td>
<td>Experimental Techniques and Data Analysis Planning</td>
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<td>13.</td>
<td>ME 519</td>
<td>Product Design and Process Applications</td>
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<td>14.</td>
<td>ME 506</td>
<td>Rapid Prototyping Principles and Applications</td>
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<td>15.</td>
<td>ME 521</td>
<td>Engineering Research Methodology</td>
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**DEPARTMENTAL REQUIREMENTS**

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<td>Automation &amp; Robotics Lab (Lab – I)</td>
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* Excellent/Very Good/Good/Satisfactory/Unsatisfactory
ME 501

AUTOMATION

Instructions 3 periods/week
Duration of university Examination 3 hours
University Examination 80 Marks
Sessional 20 Marks

UNIT – I

UNIT – II

UNIT – III

UNIT – IV

UNIT – V

Suggested Reading:
CONTROL OF DYNAMIC SYSTEMS

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

UNIT-I
Mathematical Modeling of physical systems, 1st, 2nd order and higher order systems, transient, steady state analysis, steady state errors, Performance Indices.

UNIT-II
Poles, zeros, zero and pole placements, Routh’s criteria, Root locus Technique, Bode plots, Nyquist criterion, Compensation circuits.

UNIT-III
State space method, state transition matrix, canonical forms, Diagonalisation, solutions of homogeneous and non homogenous equations, zero and pole placement using state space techniques, controllability and observability, state controllability matrix, state observability matrix.

UNIT-IV
Non-Linear Systems

UNIT-V
Stability Analysis
Concept of stability, Stability in the sense of Lyapunov and absolute stability, autonomous systems, the invariance principle, linear systems and linearization, non autonomous systems, linear time varying systems and linearization.

Suggested Reading:
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 Readings:

ME 530

ADVANCED KINEMATICS

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<th>Instruction</th>
<th>3 Periods /Week</th>
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<tr>
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<tr>
<td>Sessional</td>
<td>20 Marks</td>
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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 Reading:

With effect from the academic year 2012-2013

ME 531

FLUID POWER SYSTEMS

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

UNIT - I
Advantages and Disadvantages of Fluid control, Types of Hydraulic Fluids, physical, chemical and thermal properties of hydraulic fluids, selection of hydraulic fluid, fluid flow fundamentals.

UNIT - II
Hydraulic Pumps and Motors: Basic Types and constructions, ideal pump and motor analysis, Performance curves and parameters,
Hydraulic Control Valves: Valve configurations, general valve analysis, critical center, open center, three way spool valve analysis and Flapper valve analysis, pressure control valves, single and two stage pressure control valves, flow control valves, introduction to electro hydraulic valves.

UNIT - III
Hydraulic Power Elements: Valve controlled motor, valve controlled piston, three way valve controlled piston, pump controlled motor, pressure transients in power elements.

UNIT - IV
Characterisitcs of Pneumatics, Applications of Pneumatics, Basic Pneumatic elements, Steady flow of Ideal gases, orifice and nozzle calculations, capillary flow, flow of real gases, linearised flow equations in Orifices and Nozzles.
Steady state analysis of pneumatic components: Multiple restriction and volume calculations, sensing chambers, valves, Single acting actuators.

UNIT - V
Transients in elementary pneumatic systems: Linear dynamics-linear pneumatic spring rate, linear dynamics of a variable volume of gas, Pneumatic transmission lines, linear dynamics in single acting actuators.
Applications in industrial process controls: On-Off pneumatic feedback systems, feedback control of proportional gain, derivative action, integral action, Design of a Pneumatic Pressure Regulator.

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

ME 532

COMPUTER AIDED MECHANICAL DESIGN AND ANALYSIS

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

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 533

**MICRO-CONTROLLERS AND ITS APPLICATIONS**

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<tr>
<td>Sessional</td>
<td>20 Marks</td>
</tr>
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**UNIT-I**

Binary data representation: decimal system, binary system, octal system, hexadecimal system, binary coded decimal system, decimal conversion, decimal to Hexadecimal, binary addition and subtraction, binary multiplication and division, binary coded decimal addition, signed numbers, twos complement arithmetic, hexadecimal arithmetic, digital logic gates, MCS51 Microcontroller – difference between microcontroller and microprocessor, criteria for choosing a microcontroller, internal architecture of MCS51 microcontroller and its family.

**UNIT-II**

8051 assembly language programming: instruction set- arithmetic, logical, data transfer branching and Flag manipulation Instructions, addressing modes

**UNIT-III**

8051 timer/counter, serial communication programming, interrupts structure, interrupt programming, usage of C programming to 8051 family.

**UNIT-IV**

Real word interfacing: Analog to Digital converter, Digital to Analog converter, Mechanical switches, keypads, LEDs, seven segment display, LCDs, keyboard, DC motor, stepper motor, PWM, External Memory Interface.

**UNIT-V**

Microcontroller Applications: C programming of Podium timer, microcontroller based menu card, chimney sentinel, counting cars, anonymous voting, efficient lighting using microcontroller, I²C interface with serial EPROM, reading a PWM waveform using microcontroller, 8051 based pick and place robot.

**Suggested Reading:**

1. Mazidi, The 8051 microcontroller and embedded system, Pearson education, 2002
5. Kenneth Hintz and Daniel Tabak, Microcontrollers architecture, Implementation and programming, TMH, 2005

With effect from the academic year 2012-2013.
ME 508

FINITE ELEMENT TECHNIQUES

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

UNIT-I

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

UNIT-V

Suggested Reading:
PROGRAMMING METHODOLOGY AND DATA STRUCTURES

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

UNIT I
Programming Methodology: Introduction, Algorithm, Data Flow Diagrams, Decision Tree, Decision Table and Life Cycles of Project Development.

UNIT II
Programming in ‘C’: Data types & Memory size, Expressions, Statements, Operators, Control flows, Arrays, Pointers, Structures, Functions, Dynamic Memory Allocation and Simple programs in Mechanical Engineering.

UNIT III
Sorting and Searching Techniques: Selection sort, Quick sort, Radix sort, Heap sort. Linear search, Binary search trees and Applications in Mechanical Engineering.

UNIT IV
Data Structures: Classification of Data Structures, Definitions of Linked Lists, Double Linked Lists, Stacks and Queues. Operations and Implementations of Stack, Queues and Linked List. General and Mechanical Engineering Applications

UNIT V
Advanced Data Structures: Tree, Basic Terminology, Binary Trees, Operations on Binary tree, Tree traversals, Graph, Graph representation Adjacency matrix, Adjacency Lists and Applications.

Suggested Reading:

ME 510

COMPUTER AIDED MODELLING & DESIGN

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

UNIT-I
Introduction to CAD, Criteria for selection of CAD workstations, Shigle Design Process, Design criteria, Geometric modeling, entities, 2D & 3D Primitives.
2D & 3D Geometric Transformations: Translation, Scaling, Rotation, Reflection and Shearing, conlatenation. Graphics standards: GKS IGES, PDES.

UNIT-II
Wire frame modeling: Curves: Curve representation. Analytic curves – lines, Circles, Ellipse, Conis. Synthetic curves – Cubic, Bezier, B-Spline, NURBS.

UNIT-III
Surface Modeling: Surface entities, Surface Representation.
Analytic Surface – Plane Surface, Ruled Surface, Surface of Revolution, Tabulated Cylinder.
Synthetic Surface-Cubic, Bezier, B-spline, Coons.

UNIT-IV
Solid Modeling Techniques: Graph Based Model, Boolean Models, Instances, Cell Decomposition & Spatial – Occupancy Enumeration, Boundary Representation (B-rep) & Constructive Solid Geometry (CSG).

UNIT-V
Capabilities of Modeling & Analysis Packages such as solid works, Unigraphics, Ansys, Hypermesh. Computer Aided Design of mechanical parts and Interference Detection by Motion analysis.

Suggested Reading:
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

UNIT – IV

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:
VIBRATION ANALYSIS AND CONDITION MONITORING

ME 534

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 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.
ME 535

UNDER ACTUATED ROBOTICS

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

UNIT-I
Fully v/s under actuated systems, non linear dynamics of the simple pendulum, Acrobat and cart-pole controllability, partial feedback linearization (PFL), energy shaping

UNIT-II
Simple walking models- rimless wheels, compass gait, kneed compass gait, feedback control for simple walking models. Simple running models-spring loaded inverted pendulum (SLIP), Raibert hoppers, swimming and flapping flight.

UNIT-III
Function approximation and system identification, model systems with uncertainty, state distribution dynamics and state estimation

UNIT-IV
Introduction to optimal control, double integrator and pendulum examples, dynamic programming and value integration, grid world, quadratic regulator (Hamilton – Jacobi-Bellman sufficiency), min-time control (pontryagin), open loop optimal control, direct and indirect methods., trajectory stabilization, iterative linear quadratic regulator (ILQR).

UNIT-V
Motion planning: Dijkstra’s algorithm, A-star algorithm, randomized motion planning, rapidly exploring randomized trees, and probabilistic road maps, feedback motion planning-planning with funnels, linear quadratic regulator (LQR) trees,

Suggested Reading:
3. Fantoni, Isabelle and Rogelio Lozano, Non linear control for under actuated mechanical systems, Newyork, NY, Springer verlag, 2002
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
Characteristics of artificial Neural Networks: Single Neural Networks, Multi Layer Neural Networks, Training of ANN – objective, supervise training, unsupervised training, overview of training.

Suggested Reading:
**ME 513**

**ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**

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<td>20 Marks</td>
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**UNIT-I**
Artificial Intelligence: Definition, Study of AI techniques, problems and Problems space, AI characteristics, Heuristics.

**UNIT-II**
Computer Vision: Perception, early processing, representation and recognition of scenes, Guzman’s algorithms of spurting objects in a scene, Waltz algorithm.

**UNIT-III**
Neural Language understanding problems, syntactic analysis, semantic analysis, augmented transition networks.

**UNIT-IV**
Knowledge representation (Logic): Representing facts in logic predicate logic, resolution, unification, question answering, mathematical theorem proving.
Knowledge representation (Structured): Declarative representation, Semantic nets, procedural representation.

**UNIT-V**
Learning: Learning as induction, failure drive learning, learning by teaching, learning through examples (Winston’s program) skill acquisition.

**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:
With effect from the academic year 2012-2013

ME 505
COMPUTER INTEGRATED MANUFACTURING

Instructions 3 periods/week
Duration of university Examination 3 hours
University Examination 80 Marks
Sessional 20 Marks

UNIT – I Introduction to CIM

UNIT – II CIM database and database management systems
Introduction, Manufacturing Data: Types, sources, Database Terminology, Database requirements, Database models, Database Management System, DBMS Architecture, Query Language, Structural Query Language (SQL): Basic structure, Data definition Language (Create, Alter, Drop, Truncate, View), Data Manipulation Language (store, retrieve, update, delete), Illustration of Creating and Manipulating a Manufacturing Database. SQL as a Knowledge Base Query Language. Features of commercial DBMS: Oracle, MySQL, SQL Access, Sybase, DB2. Product Data Management (PDM), Advantages of PDM.

UNIT – III CIM Technology and Systems

UNIT – IV Enterprise Wide Integration in CIM and CIM Models

CIM Models: ESPRIT-CIM OSA Model, NIST-AMRF Model, Siemens Model of CIM, Digital Equipment Corporation Model, IBM Concept of CIM.

UNIT – V Future Trends in Manufacturing Systems

Suggested Reading:
3. P.Radhakrishnan, S.Subramanyam: CAD/CAM/CIM, New Age International
4. Alavudeen, Venkateshwaran: Computer Integrated Manufacturing, Printice-Hall India
With effect from the academic year 2012-2013

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:
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 520

RAPID PROTOTYPING PRINCIPLES AND APPLICATIONS

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

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:

With effect from the academic year 2012-2013

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
AUTOMATION AND ROBOTICS LABORATORY

Instruction 3 periods/week
Sessional 50 Marks

List of Experiments

I- MATLAB
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
With effect from the academic year 2012-2013

ME 524

COMPUTATION LABORATORY

Instruction 3 periods/week
Sessional 50 Marks

List of Experiments:

1. Introduction to Finite Element Analysis Software.
2. Static analysis of a corner bracket.
3. Statically indeterminate reaction force analysis.
4. Determination of Beam stresses and Deflection.
5. Bending analysis of a Tee-shaped beam.
6. Analysis of cylindrical shell under pressure.
8. Stress analysis in a long cylinder.
9. Solidification of a casting.
10. Transient Heat transfer in an infinite slab.
11. Transient Thermal stress in a cylinder.
12. Vibration analysis of a Simply supported beam.
13. Natural frequency of a motor generator.
14. Thermal – structural contact of two bodies.
15. Drop test of a container (Explicit Dynamics).