DEPARTMENT OF
MECHANICAL ENGINEERING

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

Specialization:

DESIGN FOR MANUFACTURE

Full time / Part time
(2015-16)

UNIVERSITY COLLEGE OF ENGINEERING
(Autonomous)
Osmania University
Hyderabad – 500 007, Telangana, INDIA
### Scheme of Instruction & Examination

**M.E. (Mechanical Engineering) 4 Semesters (Full Time)**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Subject</th>
<th>Hours per week</th>
<th>Duration (Hrs)</th>
<th>Max. Marks</th>
<th>Credits</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 II.
- * One project seminar presentation.
- ** 50 marks to be awarded by guide and 50 marks to be awarded by viva-voice committee comprising Guide and two internal senior faculty members (subject experts)
### Scheme of Instruction & Examination

M.E. (Mechanical Engineering) 6 Semesters (Part Time)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Subject</th>
<th>Hours per week</th>
<th>Duration (Hrs)</th>
<th>Max. Marks</th>
<th>Credits</th>
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#### Semester – I

1. Core                                      3  --  3  70  30  3
2. Core / Elective                           3  --  3  70  30  3
3. Elective                                  3  --  3  70  30  3
4. Lab. I / Seminar - I                      -- 3  3  --  50  2
   **Total**                                  9  3  12  210  140  11

#### Semester – II

1. Core                                      3  --  3  70  30  3
2. Core / Elective                           3  --  3  70  30  3
3. Elective                                  3  --  3  70  30  3
4. Lab. I / Seminar - I                      -- 3  3  --  50  2
   **Total**                                  9  3  12  210  140  11

#### Semester – III

1. Core                                      3  --  3  70  30  3
2. Core / Elective                           3  --  3  70  30  3
3. Elective                                  3  --  3  70  30  3
4. Lab. II / Seminar - II                    -- 3  3  --  50  2
   **Total**                                  9  3  12  210  140  11

#### Semester – IV

1. Core                                      3  --  3  70  30  3
2. Core / Elective                           3  --  3  70  30  3
3. Elective                                  3  --  3  70  30  3
4. Lab. II / Seminar - II                    -- 3  3  --  50  2
   **Total**                                  9  3  12  210  140  11

#### Semester – V

1. Project + Seminar*                        -- 4  4  --  100**  8

#### Semester – VI

1. Dissertation                              -- 6  6  200  -  16

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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 to be awarded by guide and 50 marks to be awarded by viva-voice committee comprising Guide and two internal senior faculty members (subject experts)
### M. E. Mechanical Engineering (DESIGN FOR MANUFACTURE)

<table>
<thead>
<tr>
<th>Syllabus Ref. No. (Code)</th>
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<th>Scheme of Examination</th>
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CIE : Continuous Internal Evaluation    SEE : Semester End Examination
ME2601

DESIGN FOR MANUFACTURE

Instructions: 3 periods/week
Credits: 3

Duration of university Examination: 3 hours
SEE: 70 Marks
CIE: 30 Marks

UNIT-I


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


Suggested Reading:
ME2602

QUALITY AND RELIABILITY ENGINEERING

Instructions  3 periods/week  Duration of university Examination: 3 hours
Credits        3                     SEE: 70 Marks       CIE: 30 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:
DESIGN OF MANUFACTURING TOOLS

Instructions: 3 periods/week  
Duration of university Examination: 3 hours  
Credits: 3  
SEE: 70 Marks  
CIE: 30 Marks

Unit-I

Unit-II

Unit-III

Unit-IV

Unit-V

Suggested Reading:
1. Astme, Fundamentals Of Tool Design. Preantice Hall Of India Pvt Ltd New Delhi 1976
3. Joshi, Jigs & Fixtures. Tata Mc-Grawhills Publication
4. Die Casting Die BY HH Doehler Mc-Grawhill Book Company
6. Introduction To Jig & Tool Design By MHA Kempster Published By Viva Books Pvt Ltd New Delhi.
With effect from 2015 - 16

ME2403

COMPUTER INTEGRATED MANUFACTURING

Instructions  3 periods/week  Duration of university Examination: 3 hours
Credits  3  SEE: 70 Marks  CIE: 30 Marks

Objectives:
- To understand the need for CIM, evolution of CIM, fundamentals of CIM and the Concept of Concurrent Engineering.
- To know the role of database management of CIM and understand various types of CIM technologies and systems like DFMA, CAPP, MRP, Cellular Manufacturing, FMS etc.
- To understand the fundamental networking concepts that help in integrating all the important components of an enterprise and discuss the different types of CIM models developed by various industries. Stand the new trends in manufacturing systems.

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
ME2111

PRODUCT DESIGN AND PROCESS PLANNING

Instructions: 3 periods/week  Duration of university Examination: 3 hours
Credits: 3  SEE: 70 Marks  CIE: 30 Marks

Objectives:

- To learn the essential factors with innovative ideas to develop successive right product.
- To know the product reliability, copyrights, value Engineering in product design and cost estimation of product.
- To understand the various machining processes, improving tolerances methods, selection of materials and their importance.
- To understand the modern approaches, ergonomics considerations in product design, integration of design, manufacturing and production control.

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:
ME2401

FINITE ELEMENT TECHNIQUES

Instructions: 3 periods/week  
Duration of university Examination: 3 hours
Credits: 3  
SEE: 70 Marks  
CIE: 30 Marks

Objectives:
- To understand the theory and application of the finite element method for analyzing structural systems.
- To learn Approximation theory for structural problems as the basis for finite element methods.
- To learn formulations for a variety of elements in one, two, and three dimensions.
- To understand modeling and analysis of structures using planar, solid, and plate elements.

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 Axisymmmetric solids subjected of axisymmetric loading with triangular elements. Convergence requirements and geometric isotropy.

UNIT-IV

UNIT-V

Suggested Reading:
ME2501

ADVANCED METROLOGY

Instructions  3 periods/week
Credits  3

Duration of university Examination: 3 hours
SEE: 70 Marks
CIE: 30 Marks

UNIT-I
End & line standards for length, Airy & Bessel points, desirable features of end standards, slip gauge manufacture, calibration of end standards by interferometry, NPL gauge interferometer, calibration of line standards by micrometer microscope – superposition, coincidence and symmetric straddling, photoelectric microscope and Moir fringe techniques, measurement of large displacements using lasers, calibration of Tomlinson gauges by interferometry. Photoelectric Autocollimator, calibration of polygons & circular scales. Types of interchangeability, dimensional chains.

UNIT-II
Fixed & Indicating Gauges: Taylor’s principles of gauge design, limitations of ring & plug gauges, position and receiver gauges, types of indicating gauges. Comparators: Multirange Sigma comparator, Back pressure and free flow type pneumatic comparators, Differential back pressure gauge, usage of different types of jets, contact & non contact tooling. Amplification selection. Air to electric transducer, Differential transducer, Variation transducer, Pre process, In-process & Post process gauging, computation & match gauging. Usage of LVDT & Capacitive type gauge heads, Automatic inspection.

UNIT-III

UNIT-IV

UNIT-V

Suggested Reading:
ME2301

AUTOMATION

Instructions  3 periods/week  Duration of university Examination: 3 hours
Credits  3  SEE: 70 Marks  CIE: 30 Marks

UNIT – I
Introduction: Definition of automation, Types of production, Functions of Manufacturing, Organization and
Information Processing in Manufacturing, Production concepts and Mathematical Models, Automation
Strategies, Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing,
Break-Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in-process.

UNIT – II
Automation Production Lines: Automated Flow lines, Methods of Workpart Transport, Transfer
Mechanism, Buffer Storage, Control Functions, Automation for Machining Operations, Design and
Fabrication Considerations. Analysis of Automated Flow Lines: General Terminology and Analysis,
Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers,
Computer Simulation of Automated Flow Lines.

UNIT – III
Lines, The Line Balancing Problem, Methods of Line Balancing, Computerized Line Balancing Methods,
Other ways to improve the Line Balancing, Flexible Manual Assembly Lines. Automated Assembly
Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices,
Analysis of Multi-station Assembly Machines, Analysis of a Single Station Assembly Machine.

UNIT – IV
Automated Materials Handling: The material handling function, Types of Material Handling
Storage/Retrieval Systems, Carousel Storage Systems, Work-in-process Storage, Interfacing Handling and
Storage with Manufacturing.

UNIT – V
Automated Inspection and Testing: Inspection and testing, Statistical Quality Control,
Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate
Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection
Factory, The social impact.

Suggested Reading:
   Education Asia.
3. N.Viswanadham and Y.Narahari, Performance Modeling of Automated Manufacturing Syetms, Printice
   Hall India Pvt. Ltd.
   Yesdee publishing Pvt. Ltd, Chennai
ME2402

**COMPUTER AIDED MODELLING & DESIGN**

<table>
<thead>
<tr>
<th>Instructions</th>
<th>3 periods/week</th>
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**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, Conics. Synthetic curves – Cubic, Bezier, B-Spline, NURBS.

**UNIT-III**

**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**

**Suggested Reading:**
ROBOTIC ENGINEERING

Instructions 3 periods/week Duration of university Examination: 3 hours
Credits 3 SEE: 70 Marks CIE: 30 Marks

The goal of the Robotics course is to familiarize the students with the concepts and techniques in robot manipulator control, enough to evaluate, chose, and incorporate robots in engineering systems.

Objectives:
- To develop the student’s knowledge in various robot structures and their workspace.
- To develop student’s skills in performing spatial transformations associated with rigid body motions.
- To develop student’s skills in perform kinematics analysis of robot systems.
- To provide the student with knowledge of the singularity issues associated with the operation of robotic 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 control.

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.

UNIT-IV
Static force analysis of RP type and RR type planar robots, Dynamic analysis using Lagrangian and Newton-Euler formulations of RR and RP type planar robots, Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, Computed torque control, force control, 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:
ME2502  
MATERIAL SCIENCE & TECHNOLOGY

Instructions  3 periods/week  
Credits  3  
Duration of university Examination: 3 hours  
SEE: 70 Marks  
CIE: 30 Marks

UNIT-I

UNIT-II
Testing of Materials: Review and brief discussion on stress strain diagram of steel and the parameters for ductility toughness, strain hardening, and tensile strength percentage of elongation etc. Fracture toughness and crack growth measurement. Failure analysis, Factor-graphy and scanning electronic Microscope. Fatigue and Creep testing, testing for Residual stresses.

UNIT-III

UNIT-IV

UNIT-V

Suggested Reading:
7. IS Standards, BIS, New Delhi.
ME2604

MEMS AND NANO-TECHNOLOGY

**Instructions**  
3 periods/week  
**Credits**  
3  
**Duration of university Examination:** 3 hours  
**SEE:** 70 Marks  
**CIE:** 30 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, Fiber Optics & Allied components, Micro Injection Moulding and Nano Technology

**Suggested Reading:**

ME2109

THEORY OF ELASTICITY AND PLASTICITY

**Instructions** 3 periods/week

**Credits** 3

**Duration of university Examination:** 3 hours

**SEE:** 70 Marks

**CIE:** 30 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 Readings:**


ME2404

FAILURE ANALYSIS AND DESIGN

Instructions: 3 periods/week  
Duration of university Examination: 3 hours

Credits: 3  
SEE: 70 Marks  
CIE: 30 Marks

Objectives:

- To explain the importance of Good design and various factors affecting it
- To explain the importance of Ergonomics and Aesthetics in good design.
- To understand the importance of various scientific methods available to solve problems arising from product initiation state to product delivery state.
- To understand the phenomenon & importance of Fracture, its determination by various methods also understand the effect of fatigue on crack propagation.

UNIT - I

UNIT- II

UNIT - III

UNIT – IV
APPLICATIONS OF FRACTURE MECHANICS  Introduction –Through cracks emanating from holes – Corner cracks at holes – Cracks approaching holes-Combined loading-Fatigue crack growth binder- Mixed mode loading-Fracture toughness of weld metals-Service failure analysis

UNIT – V
FATIGUE CRACK PROPOGATION— Mechanism of fatigue crack initiation, propagation and growth, Fatigue data representation, Factors influencing Fatigue strength, Fatigue life prediction, prevention of fatigue failures, corrosion fatigue. Cumulative fatigue damage

Suggested Reading:
5. S T. Rolfe and J M Barsom, Fracture and Fatigue control in structure, Prentice Hall
ADDITIVE MANUFACTURING TECHNOLOGIES AND APPLICATIONS

Instructions: 3 periods/week  
Credits: 3  
Duration of university Examination: 3 hours  
SEE: 70 Marks  
CIE: 30 Marks

Objectives:
- To understand the fundamentals for additive manufacturing and how it is different and discuss about various types of liquid based, solid based and powder based AM technologies.
- To understand the various types of Pre-processing, processing, post-processing errors in AM. Also to know the various types of data formats and software’s used in AM.
- To know the various applications of AM in design analysis, aerospace, automotive, biomedical and other fields

UNIT – I


UNIT – II


UNIT – III


UNIT – IV


AM Software’s: Need for AM software, Features of various AM software’s like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, SurgiGuide, 3-matic, Simplant, MeshLab.

UNIT – V


Suggested Reading:

ME2206

COMPUTATIONAL FLUID DYNAMICS

**Instructions**  3 periods/week  
**Duration of university Examination:** 3 hours  
**Credits**  3  
**SEE:** 70 Marks  
**CIE:** 30 Marks

**Objectives:**
1. To convert the conservation equations of fluid flow in differential form into algebraic equations and apply numerical methods to obtain solutions.
2. To learn the finite difference method.
3. To learn finite volume method and solution methodology for fluid flow problems.

**UNIT-I**

**UNIT-II**

**UNIT-III**

**UNIT-IV**

**UNIT- V**

**Suggested Reading:**
ME2306

COMPUTER AIDED MECHANICAL DESIGN AND ANALYSIS

**Instructions:** 3 periods/week  
**Duration of university Examination:** 3 hours  
**Credits:** 3  
**SEE:** 70 Marks  
**CIE:** 30 Marks

**Objectives:**
- To develop students knowledge and understanding of Bending of Plates.
- To understand the basics of designing pressure vessels against internal and external pressure loads. To understand the effect of thermal stress on pressure vessel.
- To understand the phenomenon of buckling in pressure vessels and usage of various methods available to prevent buckling of pressure vessels.
- To understand the importance of numerical methods in solving multi degree freedom dynamic analysis problems.

To understand various numerical methods available for solving eigen values problems

**UNIT-I**
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-II**
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. Stress concentration at a variable thickness, thickness transition in a cylindrical vessel, about a circular hole, elliptical openings, reinforcement design.

**UNIT-III**
Buckling in vessels: Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

**UNIT-IV**

**UNIT-V**

**Suggested Reading:**
With effect from 2015 - 16

ME2308

OPTIMISATION TECHNIQUES

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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


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:
ME2101

ADVANCES IN CASTING AND JOINING PROCESSES

Instructions: 3 periods/week
Duration of university Examination: 3 hours

Credits: 3
SEE: 70 Marks  CIE: 30 Marks

Objectives:
- To understand the basic concepts and advances in casting and welding processes
- To study the metallurgical concepts and applications of casting and welding process.
- To acquire knowledge in CAD of casting and automation of welding process.

UNIT - I
Casting Design: Heat transfer between metal and mould - Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering.

UNIT - II
Casting Metallurgy: Solidification of pure metal and alloys, shrinkage in cast metals, progressive and directional solidification, Degasification of the melt-casting defects, Castability of steel, Cast Iron, Al alloys, Babbit alloy and Cu alloy.

UNIT - III
Recent Trends In Casting And Foundry Layout: Shell moulding, precision investment casting, CO₂ moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry, sand reclamation, material handling in foundry pollution control in foundry, Computer aided design of casting.

UNIT - IV

UNIT - V

Suggested Reading:
2. ASM Handbook vol.6, welding Brazing & Soldering, 2003
ME2605

MECHATRONICS AND ITS APPLICATIONS

Instructions  3 periods/week  Duration of university Examination: 3 hours
Credits  3  SEE: 70 Marks  CIE: 30 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:
ME2105

ADVANCED MANUFACTURING TECHNIQUES

Instructions 3 periods/week  
Duration of university Examination: 3 hours
Credits 3  
SEE: 70 Marks  
CIE: 30 Marks

Objectives:
- To understand the importance and have knowledge of Unconventional machining and forming processes.
- To have the knowledge of different micro machining methods.
- To understand the working principles of various Non-traditional methods in machining and forming

UNIT-I


UNIT-II


UNIT-III


UNIT-IV


UNIT-V

Micro Machining Techniques: Introduction to Micro-EDM, Electrochemical Micro machining, Abrasive jet Micro machining, Chemo-Mechanical Polishing (CMP), Abrasive flow finishing (AFF), Magnetic abrasive finishing (MAF), Magnetic Float polishing (MFP), and Magnetorheological finishing (MRF).

Suggested Reading:

1. New Technology- Institution of Engineers - Bhattacharya - India
3. Modern Manufacturing Method - Adithan - New Age International (p) Limited
FLEXIBLE MANUFACTURING SYSTEMS

Instructions: 3 periods/week
Credits: 3
Duration of university Examination: 3 hours
SEE: 70 Marks
CIE: 30 Marks

Objectives:
- To learn the evolution of flexible manufacturing systems, layouts human resources involvement.
- To know the manufacturing driving force, design scheduling of jobs, classification and coding technique.
- To familiarize with design models for processing and quality assurance, automated manufacturing and measuring systems.
- To understand the working of automated movement, storage systems, tool management, fault detection and relationship with workstations.

Unit - I
Evolution of Manufacturing Systems: FMS definition and description, General FMS considerations, Manufacturing cells, Cellular versus Flexible Manufacturing. 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 supervisor’s role, personnel selection, job classifications, employee training.

Unit - II

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:

## NON-DESTRUCTIVE EVALUATION TECHNIQUES

### Instructions
- 3 periods/week

### Credits
- 3

### Duration of university Examination
- 3 hours

### SEE: 70 Marks

### CIE: 30 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

#### 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

### Suggested Reading:
With effect from 2015 - 16

ME2001

ENGINEERING RESEARCH METHODOLOGY

Instructions  3 periods/week  Duration of university Examination: 3 hours
Credits  3  SEE: 70 Marks  CIE: 30 Marks

Objectives:
- To learn the research types, methodology and formulation.
- To know the sources of literature, survey, review and quality journals.
- To understand the research design for collection of research data.
- To understand the research data analysis, writing of research report and grant proposal.

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

Unit - III

Unit - IV
Data Collection: Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data. Sample Design, Need for sampling, some important sampling definitions, Estimation of population, Role of Statistics for Data Analysis, Parametric V/s Non Parametric methods, Descriptive Statistics, Measures of central tendency and Dispersion, Hypothesis testing, Use of Statistical software.

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
5. Vijay Upagade and Aravind Shende, Research Methodology, S. Chand & Company Ltd., New Delhi, 2009
ME2131

PRODUCTION ENGINEERING LAB

Instruction 3 Periods/week CIE: 50 Marks
Credits: 2

List of Experiments:

1. Study of the morphology of chips produced from different materials and machining processes.
2. Effect of tool geometry on chip flow direction in simulated orthogonal cutting conditions.
3. Study of cutting ratio/chip thickness ratio in simulated orthogonal cutting with different materials and tool geometry.
4. Evaluation of cutting forces using 3-D dynamometer in simple turning process.
5. Estimation of torque and thrust on a twist drill and effect of tool geometry and axial feed rate.
7. Roughness of machined surface. Influence of tool geometry and feed rate.
8. Electro chemical machining. Effect of flow rate of electrolyte and material structure on machining characteristics.
9. Study of the ultrasonic machining setup and simple experiments on mach inability of glass and other typical materials.
10. Study and operation of abrasive jet machining with simple experiments on M.R. with flow rate and standoff distance.
11. Study of the construction and operating parameters of metal spinning Lathe.
12. Study of the water hammer equipment and hydrostatic extrusion setup.
13. Extrusion of cylindrical billets through dies of different included angles and exit diameters and their effect on extrusion pressure.
14. Practice and study of blanking and punching process and their characteristic features on mechanical press with existing dies.
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.
14. Thermal-Structural contact of two bodies.
15. Drop test of a container (Explicit Dynamics).