DEPARTMENT OF MECHANICAL ENGINEERING

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

Specialization:

TOOL DESIGN

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)

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<th>Sl. No</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 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 (Tool Design)

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<th>Scheme of Examination</th>
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CIE : Continuous Internal Evaluation       SEE : Semester End Examination
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:
MATERIAL SCIENCE & TECHNOLOGY

Instructions 3 periods/week  Duration of university Examination: 3 hours
Credits 3  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.
UNIT-I

UNIT-II

UNIT-III

UNIT-IV

UNIT-V

Suggested Reading:
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**UNIT-I**

**UNIT-II**

**UNIT-III**

**UNIT-IV**

**UNIT-V**

**Suggested Readings:**
UNIT – I

UNIT – II

UNIT – III

UNIT – IV

UNIT – V

Suggested Reading:

3. Eary & Reed, Shear Working of Metals, Prentice Hall, New Delhi, 1969
ME2506

**DESIGN OF DIES**

**Instructions** 3 periods/week

**Credits** 3

**Duration of university Examination:** 3 hours

**SEE:** 70 Marks  
**CIE:** 30 Marks

**UNIT – I**


**UNIT – II**


**UNIT – III**


**UNIT – IV**

Bulk metal forming tools – Forging dies – Definition – Influence of temperature and external pressure – Glossary words applicable in forming dies – Types of forging dies, open die forming closed die forging – Methods of open die forging – Allowance and tolerances applicable to closed die forging – Factors to be considered –Forging equipment – Layout of forge shop

**UNIT – V**


**Suggested Reading:**

1. Rusinoff S.E. Forging & forming Metals, Taraporewala, 1952
3. I.S. Standards, BSI, New Delhi
With effect from 2015 - 16

ME2301

AUTOMATION

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

UNIT-IV


UNIT-V


Suggested Reading:
ME2402

COMPUTER AIDED MODELLING & DESIGN

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

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:
ME2308

OPTIMISATION TECHNIQUES

Instructions 3 periods/week

Duration of university Examination: 3 hours

Credits 3

SEE: 70 Marks

CIE: 30 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


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:
ME2311

NEURAL NETWORKS AND FUZZY LOGIC

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UNIT-I

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:
ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

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

UNIT-I

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:
With effect from 2015

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

Lean Manufacturing: Definition, Principles of Lean Manufacturing, Characteristics of Lean Manufacturing, Value of Product, Continuous Improvement, Focus on Waste, Relationship of Waste to Profit, Four...
Functions of Lean Production, Performance Measures, The Supply Chain, Benefits of Lean Manufacturing. Introduction to Agile and Web Based Manufacturing systems.

**Suggested Reading:**
3. P.Radhakrishnan, S.Subramanyam: CAD/CAM/CIM, New Age International
4. Alavudeen, Venkateshwaran: Computer Integrated Manufacturing, Printice-Hall India
UNIT-I

UNIT-II

UNIT-III

UNIT-IV

UNIT-V

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:
1. Timoshenko and Goodieer, Theory of Elasticity, Mcgraw Hill Publications 3rd Edition,
2. Madleson, Theory of Plasticity,
ME2110

EXPERIMENTAL TECHNIQUES AND DATA ANALYSIS

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

Credits: 3  
SEE: 70 Marks  
CIE: 30 Marks

Objectives:

- To understand the working principle of instruments used for cutting forces measurement and temperature measurement.
- To have knowledge of various precision measuring instruments for metallurgical studies.
- To understand the basic concept of experiment design for collection of data.
- To learn the data analysis, optimization of experimental methods for better data.

Unit - I

Unit - II

Unit - III

Unit - IV
Experiment design & data analysis: Statistical methods, Randomized 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.
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:**
ENGINEERING RESEARCH METHODOLOGY

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

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
INDUSTRIAL TRIBOLOGY

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

UNIT-I
Introduction to Tribology. Surface Topography: Texture measurement, profilometry, cartography, photogrammetry. Texture depth, out flow meter, surface prints, statistical features, mathematical representation, parameter selection, model and Ideal surface.

UNIT-II

UNIT-III

UNIT-IV
Lubrication: Basic Principles of lubrication, choice of lubrication type, selection of lubricating oils, oil-feed system, hydrodynamic, boundary and electrodynamics, lubrication. Oil changing and oil conservation, lubricant testing and specification, lubricant monitoring and Health & Safety aspects.

UNIT-V

Suggested Reading:
ME2112

ADDITIVE MANUFACTURING TECHNOLOGIES AND APPLICATIONS

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

**Credits**
- 3
- 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**
**Introduction:** Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

**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**:
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
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 machinability of glass and other typical materials.
10. Study and operation of abrasive jet machining with simple experiments on M.R. with flow rate and stand off 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.
ME2032

**COMPUTATION LABORATORY**

Instruction 3 Periods/week  
Credits : 2  
CIE 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.
14. Thermal-Structural contact of two bodies.
15. Drop test of a container (Explicit Dynamics).