# SCHEME OF INSTRUCTION & EXAMINATION

**B.E. III YEAR**  
**(MECHANICAL ENGINEERING)**

## SEMESTER – II

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**L- Lecture, T-Tutorial, D-Drawing, P- Practical**  
**Grade:** Excellent / Very Good / Good / Satisfactory / Unsatisfactory
ME 351

MACHINE DESIGN

Instruction per Week : 4 Periods
Duration of University Examination : 3 Hours
Sessionals : 25 Marks
University Examination : 75 Marks

Course Objectives:
1. To know the design of helical and leaf springs for various load considerations from stress and energy consideration;
2. To understand the design of gears such as spur, bevel and worm gears from strength and wear considerations; types of gear failure and preventive measures;
3. To understand the types of bearings used in different applications and classification;
4. To know the application of different design concepts to the design of the various components of an IC engine such as – piston, connecting rod, crankshaft etc.
5. To know the theory of bending for members with initial curvature and for various sections to design crane hooks or C-clamps.

UNIT -I


UNIT–II

ME 351

MACHINE DESIGN

Instruction per Week : 4 Periods
Duration of University Examination : 3 Hours
Sessionals : 25 Marks
University Examination : 75 Marks

Course Objectives:
1. To know the design of helical and leaf springs for various load considerations from stress and energy consideration;
2. To understand the design of gears such as spur, bevel and worm gears from strength and wear considerations; types of gear failure and preventive measures;
3. To understand the types of bearings used in different applications and classification;
4. To know the application of different design concepts to the design of the various components of an IC engine such as – piston, connecting rod, crankshaft etc.
5. To know the theory of bending for members with initial curvature and for various sections to design crane hooks or C-clamps.

UNIT –I


UNIT–II

UNIT – III

**Bearings:** Materials used for bearings, Classification of bearings, Viscosity of lubricants. Theory of hydrostatic and hydrodynamic lubrication. Design of sliding contact bearings-for axial and thrust loads.

**Rolling Contact Bearings:** Different types of rolling element bearings and their constructional details, Static and Dynamic load carrying capacity. Load- life relationship Design for cyclic loads.

UNIT – IV

**I.C. Engine Parts:** Design of Piston, connecting rod and crank shafts(single throw and overhang). Design of Flywheels for I.C. Engines and presses.

UNIT – V

**Theory of Bending:** Theory of bending of members with initial curvature- rectangular, circular, Trapezoidal & I sections. Design of crane Hooks, Machine flames and C-clamps.

**Suggested Reading:**

ME 352
METAL CUTTING & MACHINE TOOL ENGINEERING

Instruction per Week : 4 Periods
Duration of University Examination : 3 Hours
Sessionals : 25 Marks
University Examination : 75 Marks

Course Objectives:
1. To understand the geometry of tooling used on various metal cutting machines;
2. To analyze the effects of heat, lubrication and various cutting tool materials on the metal cutting process.
3. To understand the basic working and constructional features associated with common machining tools.
4. To understand the advantages and limitations of each process and equipment.
5. To understand the practical applications of a variety of machining processes and basics on modern machining operations.

UNIT-I

Cutting Tool Materials: High carbon steel, HSS, Stellite, Carbides, Coated carbides, Diamonds, CBN. Tool material properties.

Tool Geometry: Nomenclature of single point cutting tool by ASA & ORS systems. Geometry of drills, milling cutters.

Chip Formation: Types of chips, BUE, Chip breakers.

Machining: Orthogonal and oblique cutting, Mechanics of metal cutting, Merchant’s analysis, Shear angle, Solutions of Merchant and Lee & Shafer.
UNIT-II

**Thermal Aspects of Metal Cutting:** Sources of heat and heat distribution, various methods of measurement of temperature, Cutting fluids and applications.

**Tool Wear, Tool Life and Machinability:** Types of wear, mechanism of tool wear, Tool life & Machinability, Machinability index. Taylor's tool life equation.

**Economics of Machining:** Tool life for maximum production, minimum cost.

UNIT-III

**Machine Tools:** Constructional features, types and specifications of various machine tools, operations on Lathe, Shaper, Planer, Slotter, Drilling, Milling and Boring machines. Indexing methods; Quick return mechanisms; Tool holding and work holding devices; Jig Boring-principle and operation.

UNIT-IV


**Screws and Gear Manufacturing:** Tapping, Chasers, Thread rolling, Thread milling, thread grinding, Gear shaping, Gear hobbing, Gear shaving and grinding.

UNIT-V

**Jigs and Fixtures:** Design principles for location and clamping. Quick clamping devices. Types of Jigs and fixtures.

**Unconventional Machining:** Principles of working, process parameters and applications of USM, AJM, WJM, EDM, ECM, LBM and EBM.
Suggested Reading:
ME 353

CAD/CAM

Instruction per Week : 4 Periods
Duration of University Examination : 3 Hours
Sessionals : 25 Marks
University Examination : 75 Marks

Course Objectives:
1. To know the basic design process, design criteria to find alternative solution; understand parametric representation of cubic spline, Bezier and B-spline curves along with concepts of NURBS.
2. To understand the concepts of surface modeling, analytical surface, solid modeling and their different approaches like C-rep and B-rep along with mass property calculations, mechanical tolerance.
3. To know the principles of CAD database and its structure and learn the different neutral file formats, like IGES and PDES.
4. To know the different types of numerical control machine tools, its features and elements; the basic concept of part families, its layout along with CAD/CAM integration and rapid prototyping concepts.

UNIT-I


Drafting Techniques: Basic geometric elements and their creation.

Geometric Modeling: Wire frame entities and their definition, Interpolation and Approximation curves. Concept of parametric and non-parametric representation of a circle and helix curves, properties of splines.

Synthetic Curves: Parametric representation of cubic spline, Bezier and B-spline curves, continuity, properties and characteristics. Concept of NURBS.
UNIT-II

**Surface Modeling:** Analytic surfaces: Definitions of planar, surface of revolution, Tabulated cylinder, synthetic surfaces: Cubic and Bezier surfaces and coons surface.

**Solid Modeling:** C-rep and B-rep approaches, feature based and parametric modeling.

**Design Applications:** Mass property calculations, Mechanical tolerance, Finite Element Analysis, Design Review.

**2D Transformations:** Translation, Scaling and Rotation about arbitrary points, shearing and Reflection, Homogeneous representations, concatenation.

UNIT-III

**CAD Database and Data Exchange:** CAD Database and structure, CAD Exchange format: IGES, STEP and STL format.

**Numerical Control Machine Tools:** Features and elements of NC, Positional, paraxial and contouring types. Definitions of axes. Definitions of interpolation, post-processor, preparatory and miscellaneous functions, canned cycles, Tool length and cutter radius compensation. Manual and computer aided part programming (APT) for simple components, programming with MACROS.

UNIT-IV

**Computer Numerical Control:** CNC, DNC and Adaptive control systems. Typical configurations and relative features. Machining centers, introduction to FANUC, SINUMERIC controllers.

**Industrial Robots:** Robot Anatomy, Configurations, Controls, Drivers, Programming methods and Applications.

UNIT-V

**GT:** Part families, layout, part classification and coding system. Opitz, MICLASS, CODE system.

**CAPP:** Variant and Generative process planning.
FMS & CMS: Building blocks of Flexible Manufacturing systems and their control, Elements of CIMS.


CAD/CAM Integration, Turnkey CAD/CAM Systems, Introduction to Rapid Prototyping Technique, Reverse Engineering.

Suggested Reading:

ME 354

HEAT TRANSFER

Instruction per Week : 4 Periods
Duration of University Examination : 3 Hours
Sessionals : 25 Marks
University Examination : 75 Marks

Course Objectives:

1. To understand the basic concepts of heat transfer.
2. To study the concepts of conduction, convection, radiation and heat exchangers applicable for commercial and industrial use.
3. To understand the applications of various experimental heat transfer correlations in engineering applications.
4. To learn thermal analysis and sizing of heat exchanger.
5. To study and solve problems on different modes of heat transfer which are related to thermal power plants, refrigeration and air conditioning.

UNIT-I

Modes of Heat Transfer, Laws of Heat Transfer: Fourier, Newton, Stefan-Boltzmann General conduction equation in cartesian, cylindrical and spherical coordinates, One dimensional steady state conduction through slabs, hollow cylinders and spheres with and without heat generation, Effects of variable thermal conductivity in heat transfer of one dimensional steady state conduction of plate, cylinders and spheres, Steady state heat transfer through composite slabs, cylinders and spheres, Critical radius of insulation, Two dimensional analysis of steady state heat transfer in a plate with prescribed temperature on one boundary, Application of finite difference technique to two dimensional steady state conduction of a plate.

UNIT-II

Fins: Heat transfer analysis of tips with heat dissipation environment - rectangular straight and pin fins, Application of fin to temperature measurement, unsteady state conduction, Lumped parameter, analysis of a body with negligible internal temperature gradients, Transient heat transfer analysis of finite slab with specified
temperature and convective boundary conditions. Use of Grober and Heisler charts for solving problems of infinite slabs, cylinders and spheres.

UNIT-III

Convection: Dimensional analysis and its use in free and forced convection, Buckingham theorem, Physical significance of different dimensionless numbers, Application of Von-Karman integral equation for the analysis of thermal boundary layer in forced convection of flat plate, Reynold’s analogy for flow over plane surfaces, calculation of heat transfer for flow over plates, cylinders and for flow through tubes in free and forced convection using empirical formulae.

UNIT-IV

Radiation: Definition of absorptivity, reflectivity and transmissivity, Concept of black-body and emissivity. Kirchoff's law, Planck’s black body spectral distribution, Wien’s and Steffan Boltzmann law, Monochromatic and total emissive power, radiant heat exchange between two gray surfaces, Shape factor, Thermal circuit for radiant heat exchange between infinite parallel plates and between concentric, cylinders. Enclosures with black and gray surfaces, Radiation shields and re-radiation surfaces.

UNIT-V


Change of Phase: Boiling-pool boiling regimes nucleate pool boiling, effect of surface wettability on bubble contact angle, Critical heat flux, boiling in forced convection, Condensation: Film condensation, Drop wise condensation, Condensation film thickness, Heat transfer coefficient in film condensation.
Suggested Reading:


Note: During Examination necessary Charts and Tables will be supplied
ME 355

CONTROL SYSTEMS THEORY

Instruction per Week : 4 Periods
Duration of University Examination : 3 Hours
Sessionals : 25 Marks
University Examination : 75 Marks

Course Objectives:

1. To know the development of input-output relations using block diagrams, signal flow graphs of mechanical, electromechanical systems etc.; and methods of obtaining time and frequency response.

2. To understand the stability and margins for stability from characteristic equation, root-locus method or frequency response; and methods

3. To know the development of the alternative state space models of dynamic systems, and their importance in predicting time response of multiple variables of the system.

UNIT-I

Control Systems Classification: Open Loop & Closed Loop Systems. Mathematical models and Transfer functions from governing equations of mechanical, electrical, hydraulic, pneumatic, thermal systems. AC, DC servomotors & Electromechanical servo systems.

UNIT-II


UNIT-III

UNIT-IV

Nyquist Criteria: Gain and phase margins, Lead, Lag and Lead-lag compensator design, PID controller, linearization of Non linear systems,

UNIT-V


Suggested Reading:

ME 356

REFRIGERATION AND AIR CONDITIONING

Instruction per Week : 4 Periods
Duration of University Examination : 3 Hours
Sessionals : 25 Marks
University Examination : 75 Marks

Course Objectives:
1. To understand the basic concepts of refrigeration and air conditioning systems.
2. To study the methods of refrigeration for commercial and industrial applications.
3. To understand the topics related to Air-conditioning, Psychrometry, Psychrometric process
4. To understand the Design of air-conditioning systems.
5. To solve the problems related to cooling and heating system

UNIT-I


Refrigerants: Survey, Classification, Designation & Desirable properties of refrigerants. Alternative refrigerants to reduce Ozone depletion & Global Warming.

Air Refrigeration System: Analysis of Bell Coleman cycle, Applications to air craft refrigeration system

UNIT-II

Vapour Compression System: Working principle and essential components of Simple vapor compression Refrigeration cycle, Compressor, condenser, evaporator, and expansion devices, Analysis of cycle, C.O.P, Representation of the cycle on T-S,
P-H and H-S charts. Performance improvement of simple vapour compression refrigeration cycle by means of flash chamber and accumulator.

Dry and wet compression, Effect of operating conditions like evaporating pressure, condenser pressure, Liquid sub-cooling and Vapor super heating, Performance of the system.

Low temperature refrigeration system (with single load system), Compound compression with water inter cooler and Flash intercooler, Cascade refrigeration system-Analysis and advantages

UNIT-III

Vapour Absorption Refrigeration System: Simple absorption systems, COP, Practical ammonia absorption refrigeration system, Lithium bromide absorption system, Electrolux refrigerator, Common refrigerants and absorbents properties, Comparison with vapor compression refrigeration system

Steam Jet Refrigeration : Principle of working, Analysis of the system, Advantages, limitations and applications.


UNIT-IV

Psychrometry: Psychrometric properties, Psychrometric chart, construction, Representation of Psychrometric processes on the chart, Heating and Cooling with Humidification and Dehumidification, Adiabatic dehumidification, adiabatic chemical dehumidification and mixing processes

Air Conditioning Systems: Types & Components of Air Conditioning Systems, Ducting System.
UNIT-V

**Cooling Load Calculations in Air Conditioning:** Concept of bypass factor, Sensible heat factor, Apparatus Dew Point, Room Sensible Heat Factor (RSHF), Gross Sensible Heat Factor (GSHF), Different heating and cooling loads, Problems.

**Design of Air Conditioning Systems:** All fresh air, Re-circulated air with bypassed air, Design of Summer, Winter and Year round air conditioning systems, Energy conservation in air conditioned building, Case study of one building with all load calculations.

**Air Conditioning Systems:** Types, Components of air conditioner equipments, Humidifier, Dehumidifier, Filter, Grills, Fans and Blowers, Duct layout.

**Applications of Refrigeration and Air conditioning:** Food Preservation, Transport air conditioning, and Industrial applications

**Suggested Reading:**

ME 381

METAL CUTTING & MACHINE TOOL ENGINEERING LAB.

Instruction per Week : 3 Periods
Duration of University Examination : 3 Hours
Sessionals : 25 Marks
University Examination : 50 Marks

Course Objectives:
1. To gain knowledge in various machining operations.
2. To perform machining and gain hands on experience on lathe, drilling, milling, planning, shaping slotting and gear cutting.
3. To understand the influence of various machining parameters on tool life.

List of Experiments:
1. Exercise on lathe with operations of step turning, taper turning, thread cutting, knurling and boring.
2. Exercise on shaper to make rectangular and "V" grooves.
3. Cutting gear teeth using (a) Simple indexing (b) compound indexing (c) Differential indexing
4. Influence of tool material (High carbon steel, high speed steel and carbides) on shear angle by measuring thickness and length of chips.
5. Measuring the forces, by dynamometers and finding friction angle and stress on shear plane and rake plane.
6. Conducting tool life tests and finding the constant and index equation for HSS and carbide tools.
8. Grinding of HSS tool by tool and cutter grinder to a given geometry.
9. PCD drilling on radial drilling and tapping
11. Cutting of splines by using a slotting machine.
12. Machining of simple component by Electro Discharge Machining (EDM)
Suggested Reading:

ME 382

CAD/CAM LAB.

Instruction per Week : 3 Periods
Duration of University Examination : 3 Hours
Sessionals : 25 Marks
University Examination : 50 Marks

Course Objectives:

1. To know the full-scale CAD software systems designed for geometric modelling of engineering components using the concepts of sketching and various constraints in preparing the sketch.
2. To understand the various sketching tools, manipulation tools to prepare sketch.
3. To understand the computer numerical control machine tools, its features and elements; classify different types of tool path like positional, paraxial and contouring and practice manual part programming using miscellaneous and preparatory functions (M & G Codes).
4. To know the Introduction of the manufacturing process through Flexible manufacturing system and 3D Printing.

List of Experiments:

1. Practice in the use of some of the packages like: Pro-E / I-DEAS / Solid works / MDT / Inventor / CATIA etc., for Geometric modeling of simple parts (sketching).
2. Part modeling and assembly of simple parts using any of the above packages.
4. Assembly Modeling with Interference detection.
5. Assembly modeling such as Steam Engine Cross Head, Connecting rod, Non-Return Valve/Blow-off cock & Drill Jig etc.
7. Geometrical dimensioning and tolerance representation on the drawings with Layouts, standard sectional views, Detailing & Plotting.

10. Simulation and Development of NC code using any CAM software.
11. Programming for integration of various CNC machines, robots and material handling systems.

12. Exercises in 3D Printing.

**Suggested Reading:**

ME 383

INDUSTRIAL VISIT/ STUDY

At least 3 days in a semester
Sessionals/Examination

3x8=24 hours
Grade*

A minimum of two industrial visits will be arranged by department and students have to attend the visits and prepare a data report of their visits to the industries and submit to the department. Students are required to present a seminar based on their report which is evaluated by Head of the Department and two senior faculties to award the Grade*

* Excellent / Good / Satisfactory / Unsatisfactory
ME 383

INDUSTRIAL VISIT/ STUDY

At least 3 days in a semester
Sessionals/Examination

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