

SCHEME OF INSTRUCTION & EXAMINATION

B.E III YEAR (REGULAR)

(MECHANICAL ENGINEERING)

SEMESTER - II

Sl. No.	Syllabus Ref.No	SUBJECT	Scheme of Instructions		Duration in Hrs	Scheme of Examination	
			Periods per Week	L/T D/P		Maximum Marks	Univ. Exam Sessi- onals
THEORY							
1.	ME 351	Machine Design	3/1	-	3	75	25
2.	ME 352	Metal Cutting & Machine Tool Engineering	4	-	3	75	25
3.	ME 353	CAD/CAM	4	-	3	75	25
4.	ME 354	Heat Transfer	4	-	3	75	25
5.	ME 355	Control Systems Theory	4	-	3	75	25
6.	ME 356	Refrigeration & Air-conditioning	4	-	3	75	25
PRACTICALS							
1.	ME 381	Metal Cutting & Machine Tool Engineering Lab	-	3	3	50	25
2.	ME 382	CAD/CAM Lab	-	3	3	50	25
3.	ME 383	Industrial Visit/Study	-	-	-	-	Gr*
TOTAL			24	6	-	550	200

*Excellent/Good/Satisfactory/Unsatisfactory

ME 351

MACHINE DESIGN

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examinations	75 Marks
Sessionals	25Marks

Unit –I

Mechanical Springs: Introduction, Different types of springs, Materials used for springs. Helical Springs, Wahl factor, calculation of stress, deflection and energy stored in spring. Design for static and fluctuating loads. Leaf Spring: Stress and Deflection. Nipping of leaf springs. Design for static and fluctuating loads.

Unit –II

Gears Introduction to gear drives, different types of gears, materials used for gears, Spur Gear Design: Beam strength of gear tooth – lewis equation, Wear strength of gear tooth, Dynamic loads on gear tooth – Buchingman equation. Basic design of Helical, Bevel and Worm gears.

Unit –III

Bearings: Introduction, materials used for bearings, Classification of bearings, Viscosity of Lubricant, theory of Hydrostatic and Hydrodynamic lubrication. Design of sliding contact bearings. Design of aerostatic bearings and applications.

Unit –IV

Rolling Contact Bearings: Different types of rolling element bearing sand their constructional details, static load carrying capacity, Dynamic load carrying capacity, Load –life relationship, selection of bearing life. Design for cyclic loads and speeds.

I.C Engine Parts: Introduction , Materials used, design of Piston, Connection rod and Crankshaft of I.C. Engine.

Unit –V

Design of curved beams: Introduction, stresses in curved beams, expression for radius of Neutral axis for rectangular, circular, trapezoidal and T- section. Design of Crane hooks., C-clamps and machine frames.

Suggested Reading:

- 1 V. Bhandari, Machine Design, Tata Mc Graw Hill Publication, 1977
- 2 P.C.sharma and D.K. Aggarwal, Machine Design, S.K.Kataria & Sons,2003
- 3 P. Kannaiah, Machine Design sci-Tech Publications, 2003
- 4 J.E. Shigley, C. R.Mishkey, Mechanical Engineering Design Tata Mc Graw Hill Publications,2003

ME 352

METAL CUTTING AND MACHINE TOOL ENGINEERING

Instruction week	4 Periods per
Duration of University Examination	3 Hours
University Examinations	75 Marks
Sessionals	25Marks

UNIT-I

Cutting tool materials: High carbon steel, HSS, Satellite, Carbides, Coated carbides, Diamonds. Tool geometry: Nomenclature of single point cutting tool by ASA & ORS systems. Geometry of drills, cutters and broaches. 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

Theoretical estimation of forces in turning, drilling and milling. 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. Taylor's tool life equation. Economics of machining: Tool life for maximum production, minimum cost.

UNIT-III

Constructional features and specifications of machine tool, various operations on Lathe, Types of Lathes, Drilling, Milling. Indexing methods. Differences between shaper, planer and slotter. Tool holding and work holding devices. Quick return mechanisms, Automatic feed devices. Grinding machines. Types of grinding, Abrasives and bonds used for grinding wheels. Specification and selection of wheels. Broaching, Lapping, Honing, Polishing, Buffing and super finishing, Burnishing, Horizontal, vertical and Jig Boring machines, Location of work pieces

UNIT-IV

Screws and gear manufacturing: Screw by 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 and applications of USM, AJM, EDM, ECM, LBM and EBM. Computer control of manufacturing systems: Concepts advantages and applications of NC machines. Input and data processing devices, Manual part programming, CNC, DNC, FMS and machining centres.

Suggested Reading :

1. BL Juneja and Shekon, Fundamentals of Metal Cutting & Machine Tools, Wiley Eastern Ltd., 1987.
2. Amitab Ghosh and Mallick, Manufacturing Science, Affiliated West Press, 1985.
3. P.C. Sharma, Production Engineering, S. Chand & Co. New Delhi, 1996.
4. R.S. Raghuwanshi, Workshop Technology, Vol. II, Dhanpat Rao & Co, New Delhi, 1998.

ME 353

CAD/CAM

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examinations	75 Marks
Sessionals	25Marks

Unit –I

CAD Fundamentals: classification and basic elements of CAD workstation hardware. Brief description of graphic input and output device. Hardware integration and networking.
CAD Software: Definitions of system software and application software. OS Kernel and utilities .CAD database and structure.
2-D draughting techniques: Basic geometric elements and their creation, automatic 2-D facilities, transformations and there mathematics.

UNIT-II

Geometric modelling: 3-D wore frame modelling: wire frame entities and their definition .Interpolation and approximation of curves .concept of parametric and non-parametric representation of curves, synthetic curves and curve fitting . Definitions of Bezier, B-spline and cubic spline curves.

Surface modelling: Definitions of basic surface. Surface of revolution, blends, intersection, analytic and sculptured surfaces.

Solid modelling: Solid entities, Boolean operations, B-rep and C-rep approaches.

Brief description of design applications : Mechanical tolerance, property calculations, finite element analysis design review.

UNIT-III

Numerical Control of Machine tools: Features and elements of NC .Positional, paraxial and contouring types. Definitions of axes, punched type, formats of tape preparation. Definitions of interpolation ,post processor ,preparatory and miscellaneous functions ,canned cycles ,tool length and cutter radius compensation. Manual and computer aided post programming (APT) for simple components .Programming with MACROS.

UNIT-IV

Computer Numeric Control: Development in MCU technology .Machining centres. CNC and adaptive control systems .Typical configurations and relative features.

Industrial Robots: Classification based on manipulator configurations, relative characteristics on-line programming methods, controls, drives and applications.

UNIT-V

C.I.M : Group Technology ,part classification and coding systems of G.T. layout.

CAPP: Typical approaches and their relative features. Basic concepts of FMS, Experts systems ,Artificial Intelligence .Application of computer in management, in process measurement ,quality control ,inspection and testing CAD/CAM integration.

Suggested Reading:

1. Ibrahim Zeid. CAD/CAM, Theory and Practice ,McGraw Hill Inc. New York, 1991
2. Grover ,MP and Zimmers E.W.,CAD/CAM, Prentice Hall of India ,1989.
3. P.N.Rao N.K. Tiwari T.K. Kundra .Computer Aided Manufacturing, Tata McGraw Hill ,New Delhi,1993
4. Yoram Koren,Computer Control of Manufacturing systems, McGraw Hill Int. New York, 1994

ME 354

HEAT TRANSFER

Instruction

Duration of University Examination

University Examinations

4 Periods per week

3 Hours

75 Marks

Sessionals

25Marks

Note: During examination necessary; charts and tables will be supplied.

UNIT-I

Basic 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 plates, 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 fins 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.

Von-Karman Integral equation for the analysis of thermal boundary layer in forced convection of flat Plate. Reinhold's analogy for turbulent 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, Lambert's cosine law, Planck, Wien's and Stefan 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 in between concentric cylinders. Enclosures with black and gray surfaces. Radiation shields and re-radiation surfaces.

UNIT -V

Heat Exchangers: Classification and applications of heat exchangers in industry. Analysis and design of counter flow and parallel flow heat exchanger. Condensers and steam generators, fouling factors. Solving problems for multi pass heat exchanger using non dimensional parameter plots. 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. Solidification and Melting: Formulation of one dimensional unsteady conduction problem for solid phase in solidification and melting.

Suggested Reading:

1. J.P. Holman, Heat Transfer, McGraw Hill Publication, 1986.
2. C. Sachadeva, Fundamentals of Engineering Heat and Mass Transfer, Wiley Eastern Ltd., 1988.
3. Arora, S.C. and Domkandwar, A Course in Heat and Mass Transfer, Dhanpatrai, 2000.
4. Frank P. Incropera & David P. Dewitt, Fundamentals of Heat and Mass Transfer , John Wiley & Sons, 1990.

ME 355

CONTROL SYSTEMS THEORY

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examinations	75 Marks
Sessionals	25Marks

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

Block diagrams, Block diagram reduction. Signal flow graphs, Mason's gain formula. Transient response. Time domain specifications of 1st and 2nd order systems. Steady state error, Error coefficient, sensitivity Performance indices. Routh criteria.

UNIT-III

Routh criteria, Root Locus method. Frequency Response: Bode, Polar plots. Correlation between transient and frequency response. Bandwidth. Experimental determination of transfer functions.

UNIT-IV

Nyquist criteria. Gain and phase margins, Lead , lag and Lead-lag compensator design, PID controller, linearization of Non linear systems.

UNIT-V

State - space representation of linear control systems. State transition matrix. Solution of state equations: Zero input response and Zero state response. Concept of controllability and observability.

Suggested Reading:

1. Dorf, R. C., "Modern Control Systems", Addison-Wesley 1989.
2. M. Gopal, "Control Systems", Tata McGraw Hill, 2004.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, 2004.
4. Norman S. Nise, "Control Systems Engineering", John Wiley & Sons, Inc., 200 I.

ME 356

REFRIGERATION & AIR CONDITIONING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examinations	75 Marks
Sessionals	25Marks

UNIT-I

Introduction to Refrigeration: Definition of refrigeration and air conditioning, necessity of refrigeration and its application. Methods of refrigeration, unit of refrigeration and COP. Reversed Carnot cycle-limitations, effect of operating temperatures.

Properties of Refrigerants: Survey, designation, Desirable properties of Refrigerants, Thermodynamics, chemical and physical properties. Classification of refrigerants- Halo-Carbon, Inorganic, Hydrocarbon and azetropes .Secondary refrigerants –Brines .Alternative Refrigerants, substitute for CFC refrigerants .Global warming, Green house effect and future of Refrigerants.

Air Refrigeration system: Analysis of Bell Coleman cycle/reserved Brayton cycle, open and dense air system. Application to aircraft refrigeration – simple cooling system. Bootstrap simple evaporative system, regenerative cooling system and reduced ambient cooling system.

Unit – II

Introduction to vapour compression refrigeration system: Working principle and essential component of a simple vapour compression refrigerator – compressor, condenser, evaporator and expansion devices. Analysis of the cycle COP – Representation on T – S P – H Charts.

Dry and wet compression, effect of operating conditions like – evaporating pressure, condenser pressure, liquid sub cooling and vapour super heating – performance of the system.

Low temperature refrigeration system (with single load system) – compound compression with water inter cooler and flash inter cooler with single expansion valve. Cascade refrigeration system – analysis advantages.

Unit – III

Vapour absorption Refrigeration system: Simple absorption system, COP, Practical Ammonia refrigeration absorption system, Lithium Bromide system, Electrolux refrigerator – Salient features, common refrigerant absorbents properties. Comparison with vapour compression system.

Stema Jet Refrigeration System: Principle of working, Analysis of the system, limitations and applications.

Non – Conventional Refrigeration system: Principle and operation of (i) Thermoelectric refrigeration system – seebeck effect, Peltier effect, Thomson effect analysis.(ii) Pulse tube refrigeration system(iii) Vortex tube.

Unit – IV

Introduction to Air Conditioning: Requirements of comfort air conditioning, Thermodynamics of human body, body temperature, metabolism, body defense and human tolerance, effect of heat on performance, ASHRE comfort chart, effective temperature.

Psychometry: Psychometric properties, Psychometric chart and its construction and representation of Psychometric process on chart – heating & cooling with humidification and dehumidification and adiabatic de humidification, adiabatic chemical dehumidification and mixing process.

Unit – V

Cooling load calculations in air conditioning: Concept of by-pass factor, sensible heat factor, ADP RSHF GSHF, Different cooling and heating loads – heat by conduction, convection and radiation from walls and roofs, direct heat load, heat from occupants, lighting, equipment and product load, processes heat load, infiltration air load, fresh air load and miscellaneous heat loads. – Problems.

Design of air conditioning systems – all fresh air, re-circulated air with by-passed air.

Designing for summer, winter and year around air conditioning processes. Energy conservation in air conditioning building.

Case study of one building with all load calculations.

Air conditioning systems. – Types of Air Conditioning systems, components of A/C equipment – humidifier, de humidifier, filters, grills, fans blowers. Duct layout. Refrigeration and air conditioning applications in (i) food reservation (ii) transport air conditioning and (iii) industrial application.

Suggested Reading:

1. S.C.Arora and S.Domkundwar, A course in refrigeration and air conditioning - Dhanpat Rai and Sons, 1996
2. V.K.Jain – Refrigeration and Air Conditioning – Tata Mc Graw Hill, 1989.
3. C.P Arora – Refrigeration and Air Conditioning - Tata Mc Graw Hill, 1989.
4. Stocker W.S., “Refrigeration and Air Conditioning”, Mc Graw Hill, 1958.

ME 381

METAL CUTTING AND MACHINE TOOL ENGINEERING LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examinations	50Marks
Sessionals	25Marks

1. Exercise with operation of step turning, taper turning and thread cutting.
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. Finding shear angles 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.
7. Measurement of chip-tool average temperature by thermocouple method.
8. Grinding of angles of HSS tool by tool and cutter grinder.

ME 382

CAD/CAM LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examinations	50 Marks
Sessionals	25 Marks

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.
3. Static structural Analysis using 2D truss/beam/etc., for different types of loads using ANSYS/NASTRAN/ADINA etc.,
4. Dynamic Structural Analysis: modal and harmonic analysis
5. Steady State heat transfer and transient heat transfer analysis.
6. Analysis of typical components like connecting rod, pressure vessel, chimney etc..
7. Facing and turning, step turning, taper turning, contouring on CNC lathe.
8. Pocketing and contouring on CNC milling machine.
9. Simulation and development of NC code using any CAM software.
10. Programming for integration of various CNC machines, robots and material handling systems.

ME 383

INDUSTRIAL VISIT/STUDY

A minimum of two industrial visits will be arranged by the department and students have to attend the visits and prepare a detailed report of their visits to the industries and submit to the department. The department evaluates their reports by a committee consisting of

Head of the Department and two more members from the Senior Faculty and assigns the Grade*.

* Excellent/ Good/ Satisfactory/ Unsatisfactory