ME 291

MECHANICAL TECHNOLOGY LAB
(For EEE & IE)

Instruction	3	Periods per we
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Performance test on multi-cylinder petrol or diesel engine
2. Measurement of discharge by Venturi meter
3. Measurement of velocity by Pitot tube
4. Measurement of discharge by Orifice meter / Rotameter
5. Determination of Flash and Fire points of lubricants
6. Determination of Thermal conductivity of a composite wall
7. Determination of Heat transfer coefficient under Natural convecti
9. Determination of volumetric efficiency of multi stage reciprocat air Compressor
10. Study of construction details of a Gear box (for EEE only)
11. Performance of (a) Francis, (b) Kaplan and (c) Pelton wheel Turbi
12. Performance and characteristics of (a) Reciprocating and (b) Centrifu Pumps.

SCHEME OF INSTRUCTION & EXAMINATION

B.E. IIIrd YEAR
(MECHANICAL ENGINEERING)

SEMESTER-I

Sl. No.	Syllabus Ref. No.	SUBJECT	Scheme of Instruction: Periods per week L	Scheme of Instruction: Periods per week D/P	Scheme of Examination: Duration In Hours	Scheme of Examination: Maximum Marks: Univ. Exam	Scheme of Examination: Maximum Marks: Sessionals
		THEORY					
1.	ME 301	Applied Thermodynamics	4	-	3	75	25
2.	ME 302	Dynamics of Machines	4	-	3	75	25
3.	ME 303	Design of Machine Elements	4	-	3	75	25
4.	ME 304	Hydraulic Machinery & Systems	4	-	3	75	25
5.	ME 305	Manufacturing Processes	4	-	3	75	25
		PRACTICALS					
1.	ME 331	Thermodynamics Lab.	-	3	3	50	25
2.	ME 332	Hydraulic Machinery & Systems Lab.	-	3	3	50	25
3.	ME 333	Manufacturing Processes Lab.	-	3	3	50	25
		Total	**20**	**9**	**--**	**525**	**200**

ME 301

APPLIED THERMODYNAMICS

Instruction	4 Periods per wee
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Reciprocating Air Compressors: Uses of compressed air, Classificati of compressors-single stage and multistage compressors, Derivation work done with and without clearance volume, Work done of multista compressors-effect of clearance volume on workdone -Inter-cooling a After-cooling

UNIT-II

Internal Combustion Engines : Classification, working princip Deviation of actual cycles from air standard cycles, Index of compressio and expansion for variable specific heats, Battery and Magneto ignitio systems, Multipoint fuel injection system, Lubrication systems, Coolin systems, Carburetors-Simple and Zenith carburetors-Valve and Port-timin diagrams. Performance of I.C. engines-Determination of Indicated powe brake power, frictional power, brake thermal efficiency, mechanic efficiency, indicated thermal efficiency, relative efficiency, volumetr efficiency, specific fuel consumption based on brake power and indicate power, Heat balance sheet.

UNIT-III

Combustion in I.C. Engines: Combustion phenomena in spark ignitio engines and compression ignition engines-Premixed and diffusion flame Mechanics of propagation, Self ignition process, Limits of self ignitio Fuel requirements and fuel rating- Anti-knock additives like TEL etc merits and demerits. Effect of engine variables- Stages of combustion Delay period, Period of uncontrolled combustion, Period of controlle combustion, Afterburning. Types of combustion chambers in spark ignitio and compression ignition engines-Air pollution from 1C engines- Effect and control of exhaust from engines.

UNIT-IV

Steam Boilers: Classification of boilers-Fire tube boilers- Cochran boiler, Locomotive boiler, Water tube boilers-Babcock and Wilcox boiler, Super critical boilers-Benson, Fluidized bed combustion boilers, Boiler mountings and accessories. Boiler performance and boiler draught-Chimney design, Types of condensers Jet and Surface condensers, introduction to cooling towers.

UNIT-V

Steam power plant: Working Carnot and Rankine cycles, cycle analysis, Modified Rankin cycle, Cycle efficiency improvement methods, Reheating, Regeneration and Cogeneration.

Steam nozzles: Types of nozzles, Nozzle efficiency, Velocity of steam flowing through the nozzle. Mass of steam discharged from the nozzle, Condition for maximum discharge, Critical pressure ratio. Diameters of nozzle throat and exit for maximum discharge.

Suggested Reading:

1. Heywood. J.B, *"Internal Combustion Engine Fundamentals "*, Tata McGraw Education Pvt. Ltd., New Delhi 2011.
2. Ganeshan.V, *"Internal Combustion Engines"*, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
3. Ballaney. P.L, *"Thermal Engineering"*, Khanna Publishers, New Delhi, 2010.
4. Rajput. R. K, *"Thermal Engineering"* Laxmi Publishers, New Delhi, 2004.
5. Mahesh M Rathor, *"Thermal Engineering"* Tata McGraw Education Pvt. Ltd., New Delhi 2010.

ME 302

DYNAMICS OF MACHINES

Instruction	4	Periods per we
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Static and Dynamic: Force analysis of 4-bar and slider cr. mechanisms. Study of dynamically equivalent system, Inertia forces connecting rod. **Gyroscope:** Gyroscopic couple, gyroscopic effects vehicles.

UNIT-II

Governors: Classification of governors, Watt, Porter, Hartnell and Hart governors, Controlling Force, Stability, Isochronism, Sensitivity, Po and Effort of governors.

Flywheels: Functions, Differences between flywheel and governor. Tur moment diagrams, flywheel analysis for I.C. Engines and Presses.

UNIT-III

Forces: Forces on bearings due to rotating shaft carrying several mas in several planes. Determination of balance masses from the forces on bearings, Shaking forces in single cylinder engine, Partial balancing reciprocating engine. Balancing of two cylinder locomotive engi Balancing of multi cylinder in-line engines. Balancing of radial engines direct and reverse cranks method.

UNIT-IV

Vibrations: Vibrations of Single degree freedom system (axial, transve and torsional). Equivalent system of combination of springs, stepped sh whirling speed of shafts.

Damped vibrations: Types of damping, Vibrations with viscous dampi

Forced vibrations: Vibrations with harmonically applied force with visc damping. Dynamic magnifier, Resonance, Vibration isolation a Transmissibility.

UNIT-V

Torsion: Torsional vibrations of two rotor, three rotor and geared systems. Natural frequencies of two degree freedom systems. Modes of vibration. Approximate methods for determining natural frequencies: Dunkerley's method, Rayleigh's method and Holzer's method for multi rotor system.

Suggested Reading:

1. S.S. Rattan, *"Theory of Machines"*, Tata McGraw Hill, Tata McGraw Education Pvt. Ltd., New Delhi 2010.
2. Thomas Bevan, *"The Theory of Machines"*, CBS Publishers & Distributors, 2004.
3. John J. Uicker, Jr., Gordon R. Pennock, Joseph E. Shigley, *"Theory of Machines and Mechanisms"*, Oxford University Press, 2003.
4. J.S. Rao and Gupta, *"Theory and Practice of Mechanical Vibrations"*, Prentice Hall, 1984.
5. R.L. Norten, *"Kinematics and Dynamics of Machinery"* Tata McGraw Education Pvt. Ltd., New Delhi 2009.

ME 303

DESIGN OF MACHINE ELEMENTS

Instruction	4 Periods per we
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Design considerations of Machine Elements. Materials used machine design and their specifications according to Indian Standar Codes and standards used in design. Important mechanical properties materials used in design. Preferred numbers. Manufacturing considerati in design. Review of types of loads and simple stresses. Stresses due Biaxal andTriaxal loads. Factor of safety. Theories of failures. Design components subjected to impact loading.

UNIT-II

Design for Fatigue: Fluctuating stresses, fatigue strength and enduran limit Stress concentration factor and Notch sensitivity. Factors affecti fatigue strength. S-N diagram, Soderberg and Modified Goodman diagrams for fatigue design. Cumulative fatigue - Miner's rule.

UNIT-III

Design of shafts: solid, hallow and splined shafts under torsion a bending loads. Design of keys. Design of couplings - Muff, Split muf Flange, Flexible, Marine type couplings.

UNIT-IV

Design of Joints: Cotter and Knuckle joints. Design of pulleys. Desig of chain drives linked and laminated chains. Design of bolts and nut Locking devices for nuts, Bolts of uniform strength. Bolted joints unde eccentric loads. Design of gasket joints.

UNIT-V

Design of Screws: Design of power Screws and screw jack. Differenti and Compound Screws. Design of rivetted and welded joints under direc and eccentric loads.

Suggested Reading:

1. M.F. Spotts, "*Design of Machine Elements*", Pearson Edu, 7th edn. 2003.
2. V. B. Bhandari, "*Design of Machine Elements*", Tata McGraw-Hill Publ, 3rd Edn. 2010.
3. P.C. Sharma & D.K. Aggarwal, "*Machine Design*", S.K. Kataria & Sons, 10th edn, 2003.
4. P. Kannaiah, *Machine Design*, Sci-Tech Publ., 2009.
5. J.E. Shigley & Charles R. Mischke "*Mechanical Engineering Design*", Tata McGraw-Hill., 6th ed. 2010.

ME 304

HYDRAULIC MACHINERY AND SYSTEMS

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

UNIT-I

Hydraulic Machines: Classification– Impulse momentum equation– Layout of hydraulic power plant – Working principle - Impact of jet on vanes –Force exerted by a jet striking (i) a fixed flat vertical vane held normal to the jet flow (ii) At the centre of a fixed symmetrical curved vane (iii) At one end of fixed symmetrical and unsymmetrical curved vanes (iv) Flat vertical vane moving in the direction of jet (v) A series of flat vertical moving vanes (vi) At the centre of a symmetrical moving curved vane (vii) A symmetrical curved vane moving in the same direction as that of jet at inlet (viii) At one end of an un-symmetrical moving curved vane (ix) Hinged plate

UNIT-II

Reciprocating Pumps: Classification, working principle-single and double acting pumps-discharge, work done and power required to drive the pumps-slip, % slip and negative slip- variation of pressure head in the

suction and delivery pipes due to acceleration of piston- variation pressure head due to friction in the suction and delivery pipes -Indica diagrams- Ideal and actual diagrams – Effect of piston acceleration pipe friction on indicator diagram- Maximum speed at which the pu must run to avoid separation during suction and delivery strokes-Air vess Function of air vessels- Work saved by fitting air vessels to single a double acting pumps – Discharge of liquid into and out of air vess Performance characteristic curves.

Other types of pumps: Working principles and characteristics of g pump and jet pump.

UNIT-III

Centrifugal pumps: Classification – Working principle – Comparis over reciprocating pumps – Velocity triangles – Manometric head – Wo done per second – Head equivalent of work done – Manometr mechanical and overall efficiencies – Pressure rise in the impeller Minimum starting speed – Specific speed – Physical significance of speci speed – Model testing – Conditions of similarity of CF pumps – Primin Performance characteristic curves – Troubles (operational difficultie reasons and remedies in CF pumps – Cavitation – Effects of Cavitation Precautions against Cavitation, working principle and characteristics o self priming pump.

UNIT-IV

Hydraulic Turbines: Classification of impulse and reaction turbines Construction and working of Pelton wheels, Francis turbine and Kapl turbine – Velocity triangles – Work done (power developed) – Hydrauli Mechanical and Overall efficiencies – Maximum efficiency – Comparis between Impulse and reaction turbines – Comparison between Franc and Kaplan turbines – Specific speed – Physical significance of speci speed – Unit quantities – Model testing of turbines – Conditions for similari of turbines – Draft tubes – functions and types of draft tubes – Surg tanks – Functions and types of surge tanks – Performance characteris curves.

UNIT-V

Industrial Hydraulics: Basic components of hydraulic circuits; Propertie and types of hydraulic oils; Working principles of external Pumps - gea lobe, vane, radial piston and axial piston; Construction details and actuatin methods of sliding spool directional control valves. Specification of D.C. valve; Working of - flow control, pressure relief, pressure reducing and sequencing valves; Working and construction details of single acting and double acting actuator and hydraulic motor; Symbolic representation of various components; Circuit for control of single & double acting actuators; Regenerative circuit; Speed control methods of actuators: meter-in, meter-out, and bleed off; Working of various servo systems-hydro mechanical, hydraulic – hydraulic, electro hydraulic; Construction details of oil reservoir and selection criteria for pumps and actuators.

Suggested Reading:

1. Bansal, R.K., *"A text book of Fluid Mechanics and Hydraulic Machines"*, Laxmi Publication (P) Ltd., New Delhi, 2004
2. Modi, P.N., and Seth, S.M., *"Hydraulic and Fluid Machines"*, Standard Book House, New Delhi, 2004
3. Ramamrutham, S., *"Hydraulics, Fluid Mechanics and Fluid machines"*, Dhanpat Rai & Sons, New Delhi, 2004
4. Kumar, K.L., *"Engineering Fluid Mechanics"*, Eurasia Publishing House (P) Ltd., New Delhi, 2004
5. Kumar, D.S., *"Fluid Mechanics and Fluid Power Engineering"*, S.K. Kataria & Sons, 2008
6. Majumdar, S.R., *"Oil Hydraulic Systems – Principles and Maintenance"*, Tata McGrawHill, 2004, New Delhi.

ME 305

MANUFACTURING PROCESSES

Instruction	4 Periods per we
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Casting Process : Casting terms, pattern materials, types of patter pattern allowances, colour code for patterns, Moulding sands, core san properties of moulding sand and its ingredients, different types of mould machines, Directional solidification, use of chaplets, chills, riser and gat design.

UNIT-II

Special Casting Processes: Shell moulding, Co_2 moulding, die casti centrifugal casting, investment or lost wax process; Casting defects, cau and remedies, Inspection and testing of casting. Furnaces used in found Cupola, Induction and Arc furnace.

Processing of plastics - Extrusion, Injection moulding, Blow moulding a Thermoforming.

Introduction to Composites and MEMS.

UNIT-III

Welding Processes: Solid state welding processes - Friction weldi Forge welding, Explosive welding and ultrasonic welding, Gas weldi Arc welding- SMAW, SAW, GMAW, GTAW, PAW, Atomic hydrog welding, principle of Soldering and Brazing.

UNIT-IV

Special Welding Processes: Laser beam welding, Electron bea welding, Thermit welding, and Electro slag welding. Resistance weldi processes - Spot welding, Projection welding, Seam welding, Butt weldi weldability, Welding defects.

UNIT-V

Forming Processes: Cold & Hot working, Yield criteria, Proce description of Forging, Rolling, Extrusion, Wire drawing, Blanking, Piercin

Bending, Deep drawing, Stretch forming, Spinning. Introduction to unconventional forming processes-Explosive forming, Electro-magnetic forming, Electro-hydraulic and rubber pad forming.

Suggested Reading:

1. P.N.Rao, "*Manufacturing Technology*," Vol. 1, Tata McGraw Hill Publ., 3rd Ed., 2011.
2. Amitabh Ghosh & Mallick, "*Manufacturing Science*", Assoc. East west Press Pvt. Ltd. 4th Ed., 2011.
3. Roy A. Lindberg, *"Materials & Process of Manufacturing"*, Prentice Hall of India, 5th Ed.1992.
4. Serope Kalpakjian, "*Manufacturing Engineering and Technology*", Addison, Wesley Publishing Company, 2006
5. George.E. Dieter, *"Mechanical Metallurgy"*, SI Metric Edition McGraw-Hill Book Company
6. J.P.Kaushish, *"Manufacturing Processes"*, PHI Learning Pvt. Ltd., 2nd, 2010

ME 331

THERMODYNAMICS LAB

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

1. To determine volumetric efficiency, isothermal efficiency and mass flow rate of a two stage reciprocating air compressor.
2. To determine valve/ port timing diagram of a Petrol/Diesel engine.
3. To conduct performance test on single cylinder Diesel engine.
4. To conduct heat balance test on a Diesel engine.
5. To conduct Morse test on multi cylinder Petrol engine.
6. To conduct performance test on multi cylinder Petrol engine.
7. To conduct performance test on a two-stroke Petrol engine.
8. To conduct performance test on multi cylinder Diesel engine.

9. To study the performance of a Petrol engine under differe compression ratios.
10. Exhaust gas analysis of Petrol engine for carbon-monoxide a unburnt hydrocarbons.
11. Exhaust gas analysis of Diesel engine for carbon deposits using smo meter.
12. Determination of viscosity of lubricating oil.
13. Determination of flash and fire points of a fuel

ME 332

HYDRAULIC MACHINERY AND SYSTEMS LAB

Instruction	3	Periods per wee
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Performance and characteristic curves of reciprocating pump.
2. Performance and characteristic curves of centrifugal pump.
3. Performance and characteristic curves of self priming pump.
4. Performance and characteristic curves of gear pump
5. Impact of jet on fixed flat vanes and curved vanes
6. Performance and characteristic curves of Pelton wheel
7. Performance and characteristic curves of Francis Turbine
8. Performance and Characteristic curves of Kaplan turbine.
9. Study of hydraulic circuits
10. Study of pneumatic circuits.
11. Study of positive displacement and roto dynamic pumps with the help of models.

ME 333

MANUFACTURING PROCESSES LAB

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

Foundry

1. Single piece pattern making with wood as material considering allowances (Draft, Shrinkage and Machining)
2. Green sand mould making processes with complete sprues, gates, riser design.
3. Testing of green sand properties
4. Melting and casting of aluminum metal
5. Study of defects in castings

Welding

1. Study of arc welding, gas welding and resistance welding processes
2. Identification of different types of flames and making a butt joint with gas welding
3. Making a lap joint by resistance welding process and strength evaluation
4. Study of bead geometry in AC and DC welding processes
5. Exercises using TIG and MIG welding processes
6. Study of welding defects

Forming

1. Evaluation of formability using Erichsen cupping test
2. Design study of simple dies and performing blanking and piercing operations using mechanical/ fly presses and measurement of forces in the operation and comparing with the theoretical loads.
3. Study of simple, compound and progressive dies and making simple components
4. Manufacturing of a simple component using Plastic Injection moulding machine

SCHEME OF INSTRUCTION & EXAMINATION

B.E. IIIrd YEAR
(MECHANICAL ENGINEERING)

SEMESTER - II

Sl. No.	Syllabus Ref. No.	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per week		Duration In Hours	Maximum Marks	
			L	D/P		Univ. Exam	Sessional
		THEORY					
1.	ME 351	Machine Design	4	-	3	75	2
2.	ME 352	Metal Cutting & Machine Tool	4	-	3	75	2
3.	ME 353	CAD / CAM	4	-	3	75	2
4.	ME 354	Heat Transfer	4	-	3	75	2
5.	ME 355	Control Systems Theory	4	-	3	75	2
6.	ME 356	Refrigeration & Air Conditioning	4	-	3	75	2
		PRACTICALS					
1.	ME 381	Metal Cutting & Machine Lab.	-	3	3	50	2
2.	ME 382	CAD / CAM Lab	-	3	3	50	2
3.	ME 383	Industrial Visit / Study	-	-	-	-	*G
		Total	**24**	**6**	**--**	**550**	**20**

** Excellent / Very Good / Good / Satisfactory / Unsatisfactory*

ME 351

MACHINE DESIGN

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

UNIT-I

Mechanical Springs: Types of springs and materials used. Design of helical springs on stress, deflection and energy considerations. Design for fluctuating loads. Concentric springs. Leaf Springs: Stresses and Deflection. Principles of Limit design. Nipping of Leaf springs.

UNIT-II

Gears: Types of gears and materials used. Standards for gear specifications. Design of Spur, Helical, Bevel and Worm Gears - Strength and Wear considerations. Types of failure of gear tooth and preventive measures.

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 and Trapezoidal sections. Design of crane Hooks, Machine flames and C-clamps.

Suggested Reading:

1. M.F. Spotts, *"Design of Machine Elements"*, Pearson Edu, Edn. 2003.
2. V. B. Bhandari, *"Machine Design"*, Tata McGraw-Hill Publ, 20
3. P.C.Sharma & D.K. Aggarwal, *"Machine Design"*, S.K. Kata & Sons, 10th Edn, 2003.
4. P. Kannaiah, *"Machine Design"*, Sci- Tech Publ., 2009.
5. J.E. Shigley & Charles R. Mischke, " *Mechanical Engineer Design"*, Tata McGraw-Hill., 6th ed. 2003.

ME 352

METAL CUTTING & MACHINE TOOL DESIGN

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

UNIT-I

Cutting Tool Materials: High carbon steel, HSS, Stellites, Carbides, Coated carbides, Diamonds. 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 and specifications of machine tools, various operations on Lathe, Types of Lathes, capstan and turret Lathes, Drilling, Milling and, Boring machines. Indexing methods. Differences between shaper, planer and slotter. Tool holding and work holding devices. Quick return mechanisms.

UNIT-IV

Grinding Machines: Types of grinding, Abrasives and bonds used for grinding wheels. Specification and selection of grinding wheels. Broaching, Lapping, Honing, Polishing, Buffing and super finishing, Burnishing.

Screws and Gear Manufacturing: Tapping, Chasers, Thread rollin
Thread milling, thread grinding. Gear shaping, Gear hobbing, Gear shavi
and grinding.

UNIT-V

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

Unconventional Machining: Principles of working and applications
USM, AJM, EDM, ECM, LBM and EBM (Mechanism and Theory
MRR and Process parameters in each case).

Suggested Reading:

1. B.L. JuneJa and Shekon, *"Fundamentals of Metal Cutting
Machines Tools"*, Wiley Eastern Ltd. 1987.
2. P.N. Rao, *"Manufacturing Technology – Metal Culling
Machine Tools"*, Vol. 2, Tata McGraw Hill Education Pvt. Lt
2010.
3. Amitab Ghosh and Mallick, *"Manufacturing Science"*, Affiliate
East West Press 1985.
4. P.C, Pandey & Shan HS, *"Modern Machining Process"*, Ta
McGraw-Hill Education 1980.
5. A. Bhattacraryya, "*Metal Cutting Theory and Practice*" Ne
Central Book Agency (P) Ltd., Calcutta, 1996.

ME 353

CAD / CAM

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

UNIT-I

Design Processes: Design criteria, Alternative solutions, Alternative design, Computer Aided Design and Review.

Drafting Techniques: Basic geometric elements and their creation.

Geometric Modelling: Wireframe 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. Introduction to NURBS.

UNIT-II

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

Solid Modeling: C - rep and B - rep approaches

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

2D Transformations: Translation, Scaling and Rotation about arbitrary point, Shearing and Reflection, Homogeneous representation, concatenation.

UNIT-III

CAD Database and Data Exchange: CAD Database and Structure, 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 componer
Programming with MACROS.

UNIT-IV

Computer Numerical Control: CNC, DNC and Adaptive cont
systems. Typical configurations and relative features. Machining cente
Introduction to FANUC, SINUMERIC controllers. **Industrial Robo**
Robot Anatomy, Configurations, Controls, Drivers, Programming metho
and Applications.

UNIT-V

GT: Part families, layout, part classification and coding system. Op
MICLASSCODE system **CAPP:** Variant and Generative process planni
FMS & CMS: Building blocks of Flexible Manufacturing systems a
their control, Elements of CIMS. **Computer Aided Inspection and Q**
Coordinate Measuring Machine, Non contact inspection: Machine visi
Scanning Laser Beam Devices Quality control. CAD/CAM Integrati
Turnkey CAD/CAM Systems, Introduction to Rapid Prototypi
Technique, Reverse Engineering.

Suggested Reading:

1. Arvid R. Eide, Roland D. Jenison, Lane H. Mashaw, Larry L. North
"Introduction to Engineering Design" McGraw -Hill, 1998.
2. Ibrahim Zeid. *CAD/CAM, "Theory and Practice",* McGraw. H
Inc. New York, 2011.
3. Grover, MP and Zimmers E.W. *"CAD/CAM",* Prentice Hall of Ind
1989.
4. Rao, PN. *"CAD/CAM: Principles and Applications",* 2nd Editi
Tata McGraw Hill, New Delhi, 2004.
5. Yoram Koren, *"Computer Control of Manufacturing System*
McGraw Hill Int, New York, 1994.
6. Elanchezhian. C. Sunder Selwyn. T. Shanmuga Sunder, G, *"Compu*
Aided" Manufacturing, Laxmi Publications (P) Ltd., 2nd Editi
New Delhi, 2007.

ME 354

HEAT TRANSFER

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

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. Kirchoffs law, Planck's black bod spectral distribution, Wien's and Steffan Boltzmann law, Monochromati 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 blac and gray surfaces, Radiation shields and re-radiation surfaces.

UNIT-V

Heat Exchangers: Classification and applications of heat exchangers i industry, Analysis and design of counter flow and parallel flow hea exchanger, Fouling factors, Solving problems for multi pass heat exchange 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 wis condensation, Condensation film thickness, Heat transfer coefficient i film condensation.

Suggested Reading:

1. Holman, J.P., *"Heat Transfer"*, McGraw Hill Publication, New Delhi, 2010
2. Rajput, R.K., *"Heat and Mass Transfer"*, S. Chand & Company Ltd, New Delhi, 2004.
3. Yadav, R., Sanjay. and Rajay., *"Heat and Mass Transfer '*, Central Publishing House, Allahabad, 2004
4. Sachdeva,R.C., *"Fundamentals of Engineering Heat and Mass Transfer* ", New Age International (P) Ltd Publishers, New Delhi,
5. Arora, S.C. and Domkandwar., *"A course in Heat and Mass Transfer* ", Dhanpat Rai & Sons, New Delhi, 2004.

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

ME 355

CONTROL SYSTEMS THEORY

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

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 coefficients, 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., 2001.

ME 356

REFRIGERATION AND AIR CONDITIONING

Instruction	4	Periods per we
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Introduction to Refrigeration: Definition of Refrigeration and Ai conditioning, Necessity of Refrigeration and its applications, Methods Refrigeration, Unit of Refrigeration and C.O.P. Reversed Carnot cycl Limitations, Effect of operating temperatures,

Properties of Refrigerants: Survey, Designation, Desirable properti of refrigerants, Thermodynamic, Chemical and Physical properties Classification of Refrigerants, Alternative refrigerants, Substitute for CF Refrigerants, Global warming, Green House Effect and Future Refrigerants.

Air Refrigeration Systems: Analysis of Bell-Coleman Cycle or Reverse Brayton cycle, Open and Dense air system, Application to aircra refrigeration, Simple cooling system, Bootstrap refrigeration syste Regenerative cooling system and Reduced ambient cooling system.

UNIT-II

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

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

Low temperature refrigeration system (with single load system), Compoun compression with water inter cooler and Flash intercooler, Cascad 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.

Non-Conventional Refrigeration Systems: Principle and operation of Thermoelectric Refrigeration Systems, Seebeck effect - Peltier effect - Thomson effect, Analysis, Pulse tube refrigeration system.

Introduction to Cryogenics- 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

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.

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 :

1. Arora C.P., *"Refrigeration and Air conditioning"*, Tata McGra Hill, New Delhi, 2009.
2. Arora, S.C. and Domkundwar, S., *"A Course in Refrigerati and Air conditioning"*, Dhanpat Rai & Sons, New Delhi, 2010.
3. Jain, V.K., *"Refrigeration and Air Conditioning"*, S Chand Company, New Delhi, 2010.
4. Stocker, W.S., *"Refrigeration and Air conditioning "*, McGra Hill, New Delhi, 2009.

ME 381

METAL CUTTING AND MACHINE TOOL ENGINEERING LAB

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

1. Study of various machine tools, their working principles and kinematic schemes.
2. Exercise with operation of step turning, taper turning and thread cutting and boring.
3. Exercise on shaper to make rectangular and 'V' grooves.
4. Cutting gear teeth using (a) Simple indexing (b) compound indexing (c) differential indexing
5. Finding shear angle by measuring thickness and length of chips.
6. Measuring the forces, by dynamometers and finding friction angle and stress on shear plane and rake plane.
7. Conducting tool life tests and finding the constant and index equation for HSS and carbide tools.
8. Measurement of chip-tool average temperature by thermocouple method.
9. Grinding of HSS tool by tool and cutter grinder to a given geometry.
10. PCD drilling on radial drilling and tapping
11. Grinding of flat surfaces using surface girding machine and measurement of surface finish.
12. Exposure to operations like trepanning, lapping, honing and broaching
13. Study of Electro Discharge Machining (EDM)

ME 382

CAD / CAM LAB

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

1. Practice in the use of some of the packages like: Pro-E / Solid works MDT / Inventor / C ATIA etc., for Geometric modeling of simple part (sketching).
2. Part modeling and Assembly of simple parts using any of the abov packages.
3. Static Analysis of Plane Truss and 2D beam for different type of load using ANSYS / NASTRAN / ADINA etc.,
4. Static analysis of Plate with a hole to determine the SCF and Deformation and Stresses.
5. Static Analysis of connecting rod, pressure vessels.
6. Dynamic analysis: Modal Analysis of cantilever Beam and Hannoni analysis of Shaft.
7. Steady state heat transfer Analysis Cross section of chimney and Transien heat transfer analysis of solidification of casting.
8. Facing and turning, step turning, taper turning, contouring on CNC lath
9. Pocketing and contouring on CNC milling machine.
10. Simulation and development of NC code using any CAM software.
11. Programming for integration of various CNC machines, robots an material handling systems

ME 383

INDUSTRIAL VISIT / STUDY

At least 3 days in a semester	3 x 8 = 24 hour
Sessional	Grade*

A minimum of two industrial visits will be arranged by department and studen have to attend the visits and prepare a data report of their visits to the industrie and submit to the department. Students are required to present a semina based on their report which is evaluated by Head of Department and tw senior faculty to award the grade.

Excellent/Very Good/Good/Satisfactory/Unsatisfactory

SCHEME OF INSTRUCTION & EXAMINATION

B.E. IV - YEAR
(MECHANICAL ENGINEERING)

SEMESTER - I

Sl. No.	Syllabus Ref. No.	SUBJECT	Scheme of Instruction: Periods per week L	Scheme of Instruction: Periods per week D/P	Scheme of Examination: Duration In Hours	Scheme of Examination: Maximum Marks Univ. Exam	Scheme of Examination: Maximum Marks Sessionals
		THEORY					
1.	ME 401	Thermal Turbo Machines	4	1	3	75	25
2.	ME 402	Metrology & Instrumentation	4	-	3	75	25
3.	ME 403	Finite Element Analysis	4	1	3	75	25
4.	ME 404	Operations Research	4	-	3	75	25
5.		ELECTIVE – I	4	-	3	75	25
		PRACTICALS					
1.	ME 431	Thermal Engineering Lab	-	3	3	50	25
2.	ME 432	Metrology & Instrumentation Lab	-	3	3	50	25
3.	ME 433	CAE Lab	-	3	3	50	25
4.	ME 434	Project Seminar	-	3	-	-	25
		Total	**20**	**14**	**-**	**525**	**225**

ELECTIVE – I

ME 406	Neural Networks	ME 412	Computational Fluid Flows
ME 407	Automobile Engineering	ME 413	Design for Manufacture
ME 408	Non Conventional Energy Sources	ME 452	Composite Materials
ME 409	Tool Design	CE 452	Disaster Mitigation and Management
ME 411	Entrepreneurship		

SERVICE COURSE: ME 472 Industrial Administration and Financial Management (Service course to ECE)