WITH EFFECT FROM THE ACADEMIC YEAR 2008-2009

SCHEME OF INSTRUCTION AND EXAMINATION

B.E. IIIrd YEAR

MECHANICAL ENGINEERING

SEMESTER - I

Sl. No.	Syllabus Ref. No.	Subject	Scheme of Instruction		Scheme of Examination		
			Periods per Week		Duration in Hrs	Maximum Marks	
			L	D/P		Univ. Exam	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 Process	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**

WITH EFFECT FROM THE ACADEMIC YEAR 2008-2009

ME 301

APPLIED THERMODYNAMICS

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

UNIT-I

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

UNIT-II

Internal Combustion Engines : Classification, working principle, Deviation of actual cycles from air standard cycles, Index of compression and expansion for variable specific heats, Battery and Magneto ignition systems, Multipoint fuel injection system, Lubrication systems, Cooling systems, Carburetors-Simple and Zenith carburetors- Valve and Port-timing diagrams Performance of I.C. engines-Determination of Indicated power, brake power, frictional power, brake thermal efficiency, mechanical efficiency, indicated thermal efficiency, relative efficiency, volumetric efficiency, specific fuel consumption based on brake power and indicated power, air intake- Heat balance sheet.

UNIT-III

Combustion in I.C. engines : Combustion phenomena in spark ignition engines and compression ignition engines-Premixed and diffusion flames, Mechanics of propagation, Self ignition process, Limits of self ignition. Fuel requirements and fuel rating- Anti-knock additives, Effect of engine variables- Stages of combustion - Delay period, Period of uncontrolled combustion, Period of controlled combustion, After burning. Types of combustion chambers in spark ignition and compression ignition engines- Air pollution from IC engines- Effects and control of exhaust from engines.

UNIT -IV

Steam Boilers : Classification of boilers-Fire tube boilers- Cochran boiler, Locomotive boiler and Lancashire boiler, Water tube boilers- Babcock and Wilcox boiler and Sterling boiler, Super critical boilers- Benson and Union boilers, Fluidized bed combustion boilers, Boiler mountings and accessories. Boiler performance and boiler draught- Chimney design, Types of condensers Jet and Surface condensers, 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 Hill Publishing, New Delhi, 2004.
2. Ganeshan, V., *"Internal Combustion Engines"*, Tata Mcgraw Hill Publishing, New Delhi. 2004.
3. Ballaney, P.L., *"Thermal Engineering"*, Khanna Publishers, New Delhi, 2004.
4. Rajput, R. K., *"Thermal Engineering"* Laxmi Publishers, New Delhi, 2004.

ME 302

DYNAMICS OF MACHINES

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

UNIT-I

Static and Dynamic force analysis of Four bar and slider crank mechanisms.

Study of Dynamically Equivalent system. Inertia forces on connecting rod.

Gyroscope: Gyroscopic couple, Gyroscopic effects in vehicles.

UNIT-II

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

Flywheels: Functions, Differences between flywheel and governor. Turning moment diagrams, flywheel analysis for I-C Engines and presses.

UNIT-III

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

UNIT-IV

Vibrations of Single degree, freedom system (axial, transverse and torsional), Natural frequencies, Equivalent system of combination of springs, Stepped shaft, whirling speed of shafts.

Damped vibrations: Types of damping, Vibrations with viscous damping.

Forced vibrations : Vibrating with hannonically applied force with viscous damping. Dynamic magnifier, Resonance, Vibration isolation and Transmissibility.

UNIT - V

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 aε™s method, Rayleigh aε™s method and Holzer aε™s method for multi rotor system.

Suggested Reading:

1. S.S.Rattan, *Theory of Machines*, Tata aε™s MCgraw Hill, 1995.
2. Thomas Bevan, *The Theory of Machines*, CBS Publishers & Distributors.
3. John J. Uicker, Jr., Gordon R. Pennock, Joseph E. Shigley, *Theory of Machines and Mechanisms*, Oxford University Press, 2003.
4. I.S. Rao and Gupta, *Theory and Practice of Mechanical Vibrations*, Prentice Hall, 1984.
5. Ghosh and Mallik, *Theory of Mechanisms and Machines*, Affiliated East-West Press, 1988.

WITH EFFECT FROM THE ACADEMIC YEAR 2008-2009

ME 303

DESIGN OF MACHINE ELEMENTS

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT -IV

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

UNIT-V

Design of power Screws and screw jack. Differential and Compound Screws. Design of riveted and welded joints under direct and eccentric loads.

Suggested Books:

1. M.F. Spotts, *Design of Machine Elements*, Pearson Edu, 7th ed. 2003.
2. V. B. Bhandari, *Machine Design*, Tata McGraw-Hill Publ, 2004.
3. P.C.Sharma & D.K. Aggarwal, *Machine Design*, S.K.Kataria & Sons, 10th ed, 2003.
4. P. Kannaiah, *Machine Design*, Sci-Tech Publ., 2003.
5. J.E. Shigley & Charles R. Mischke, *Mechanical Engineering Design*, Tata McGraw-Hill., 6th ed. 2003.

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 machinery : Classification, Energy transfer in hydraulic turbines, Positive displacement and roto dynamic pumps, Impact of water Jet on flat plates and curved surfaces - single and series; Stationary and moving plates, Forces on hinged plates and pipe bends, Impulse-momentum equation, Flow over radial curved vanes.

UNIT -II

Reciprocating Pumps: Classification, working principle, Theory and terms used for single and double acting pumps, Effect of acceleration and friction, Indicator diagrams, Effect of cavitation and limiting suction head on speed, Variation of pressure inside pump cylinder during suction and delivery strokes. Work done, power required and efficiency, Function of air vessels, Work saved and rate of flow from air vessels, Losses and performance curves for reciprocating pumps.

UNIT-III

Centrifugal pumps: Classification of centrifugal pumps, Theory and terminology used in centrifugal pumps, Working and construction details of single" stage centrifugal pump installation, Priming-significance and methods of priming, Types of impellers, casings, and vane shapes, Simple and multi stage pumps and their applications, Series and parallel operation of centrifugal pumps, Manometric head and its importance, Manometric efficiency and other efficiencies, Losses in Pumps, Velocity diagrams, effect of number of vanes and outlet angle of vane on head developed, Design of radial impeller and volute casing, Origin of cavitation, Limiting suction lift and Net Positive Suction Head (NPSH), Principle of similarity, Unit quantities, Specific speed, Performance prediction from model testing, Performance and characteristic curves.

UNIT-IV

Hydraulic Turbines: Classification of impulse and reaction turbines and their differences.

Impulse turbines: Salient features and working details of Pelton wheel installation, Velocity diagrams, Calculation of number of buckets, bucket size and power developed, Overall efficiency, Speed regulation methods.

Reaction turbine: Construction details and working of Francis and Kaplan turbines, Velocity diagrams, Blade angles and dimensions, Power developed and efficiencies, Pressure head at inlet of the runner, Draft tube, types arid efficiency of draft tubes, Principle of similarity,Unit quantities, Specific speed and its significance for turbine selection, Performance prediction from model tests. Performance and characteristic curves for Pelton, Francis and Kaplan turbines, Losses in turbine operation, Cavitation effects in reliction turbines and remedial measures.

UNIT-V

Hydraulic equipment and System: Working and simple problems on hydraulic ram, accwnulafor, intensifier, press, jack, lift and crane, Working principles of fluid couplings and torque converter, Description of general hydraulic valves used, General description of servomechanism, Block diagram, Servo-valves, Valve operated and pwnp controlled servo mechanisms.

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., *"Hydrauilcs 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.

ME 305

MANUFACTURING PROCESSES

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

UNIT-I

Moulding sands, patterns, cores and moulding methods, moulding machines. Directional solidification, gating and risering design. Melting practices: Absorption of gases during melting, Sivert's Law. Furnaces: Cupola, Induction and Arc furnace and charge calculation for cupola.

UNIT-II

Special casting processes - Shell moulding, CO2 process, Continuous casting, die casting, investment casting and centrifugal casting. Common defects in casting - causes and remedies. Inspection and testing of casting introduction to processing of Plastics. Extrusion injection, moulding, blow moulding and thermo forming.

UNIT-III

Welding processes : Solid state welding (Friction, forge, explosive and ultrasonic welding), Gas welding, Brazing, Soldering, Arc welding Processes - SMAW, SAW, GMAW, GTAW, Atomic hydrogen and plasma arc welding. LBW, EBW, Thermit welding Electro - slag welding.

UNIT-IV

Resistance welding processes, weldability - tests, defects in welding.

Sheet metal working: design of dies for blanking, piercing, bending and deep drawing. Stretch forming, spinning and flow forming.

UNIT- V

Cold and hot working, yield criteria. Rolling, Extrusion and drawing - processes and load calculations.

Forging: Types of forging and equipment-presses and hammers, design of dies.

Suggested Reading:

1. P.N.Rao, *Manufacturing Technology*, Tata McGraw Hill Publ., 2nd Ed., 1990.
2. Amitabh Ghosh & Mallick, *Manufacturing Science*, Assoc. East West Press Pvt. Ltd. 4th Ed., 1991.
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.
5. George.E. Dieter, *Mechanical Metallurgy*, SI Metric Edition, McGraw-Hill Book Company.

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 a 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 different compression ratios.
10. Exhaust gas analysis of Petrol engine for carbon-monoxide and unburnt hydrocarbons.
11. Exhaust gas analysis of Diesel engine for carbon deposits using smoke 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 week
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 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. Testing of greensand properties.
2. Greensand mould making process with complete sprues, gates risers designs.
3. Melting and casting aluminium metal.
4. Study of defects in castings.

Welding:

1. Making of lap joint by resistance welding process and its strength evaluation
2. Identification of different types flames in gas welding process.
3. Study of bead geometry in AC and DC arc welding processes.
4. Exercises using TIG and MIG welding processes.

Forming:

1. Evaluation of True Stress - Strain characteristics of ferrous and non-ferrous test specimens in a tensile test.
2. Evaluation of formability using Erichsan cupping test.
3. 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.
4. Design study of compound / progressive / combination die and production of a typical component on the same.

SCHEME OF INSTRUCTION AND 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 Hrs	Maximum Marks	
			L	D/P		Univ. Exam	Sessionals
		THEORY					
1.	ME 351	Machine Design	4	-	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	4	-	3	75	25
6.	ME 356	Regrigeration & Air Conditioning	4	-	3	75	25
		PRACTICALS					
1.	ME 381	Metal Cutting & Machine Tool Engineering Lab	-	3	3	50	25
2.	ME 382	CAD / CAD Lab	-	3	3	50	25
3.	ME 383	Industrial Visit / Study	-	-	-	-	Gr*
		TOTAL	**20**	**9**	**-**	**550**	**200**

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 of members with initial curvature - rectangular, circular and Trapezoidal sections. Design of crane Hooks, Machine flames and C.clamps.

Suggested Books:

1. M.F. Spotts, *Design of Machine Elements*, Pearson Edu, 7th ed. 2003.
2. V. B. Bhandari, *Machine Design*, Tata McGraw-Hili Publ, 2004.
3. P.C.Sharma & D.K. Aggarwal, *Machine Design*, S.K.Kataria & Sons, 10th ed, 2003.
4. P. Kannaiah, *Machine Design*, Sci- Tech Publ., 2003.
5. J.E. Shigley & Charles R. Mischke - *Mechanical Engineering Design*, Tata McGraw-Hili., 6th ed. 2003.

ME 352

METAL CUTTING & MACHINE ENGINEERING

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, Stellite, 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, capstan and turret Lathes, automatic 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.

UNIT -IV

Broaching, Lapping, Honing, Polishing, Buffing and super finishing, Burnishing, Horizontal, vertical and Jig Boring machines.

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 and applications of USM, AJM, EDM, ECM, LBM and EBM. Metal Removal Rates and Energy Calculations.

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,* Tata McGraw Hill Book Co.
3. Amitab Ghosh and Mallick, *Manufacturing Science*, Affiliated East West Press 1985.
4. P.C. Pandey & Shan HS, *Modern Machining Process.*
5. HMT, *Production Technology.*

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 : Wire frame entities and their definition, Interpolation and Approximation curves. Concept of paramatric 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.

Solid Modeling: C - rep and B - rep approaches

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

2D Transformations and their Mathematics: Translation, Scaling and Rotation about arbitrary points, Shearing and Reflection, Homogeneous representations, concatenation.

UNIT-III

CAD Database and Data exchange: CAD Database and structure, IGES and PDES 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 &CJMS: Building blocks of Flexible Manufacturing systems and their control, Elements of CIMS.

Computer Aided Inspection and QC : Coordinate Measuring Machine, Non contact inspection: Machine vision, Scanning Laser Beam Devices, Quality control.

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

Suggested Reading:

1. Arvid R.Eide, Roland D. Jenison, Lane H.Mashaw, Larry L. Northup, *"Introduction to Engineering Design"* Mc Graw - Hill, 1998.
2. Ibrahim Zeid. *CAD/CAM, Theory and Practice*, McGraw Hill Inc. New York, 1991.
3. Grover, MP and Zimmers E.W. *CAD/CAM,* Prentice Hall of India, 1989.
4. Rao, P.N. *CAD/CAM : Principles and Applications,* 2nd Edition, Tata McGraw Hill, New Delhi, 2004.
5. Yoram Koren, *Computer Control of Manufacturing Systems,* McGraw Hill Int, New York, 1994.
6. Elanchezhian, C, Sunder Selwyn, T., Shanmuga Sunder, G., *Computer Aided Manufacturing,* Laxmi Publications (P) Ltd., 2nd Edition, New Delhi, 2007.

WITH EFFECT FROM THE ACADEMIC YEAR 2008-2009

ME 354

HEAT TRANSFER

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

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

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 sphers, 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, reflexivity and transmissivity, Concept of black-body and emissivity. Kirchoffs 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 reradiation surfaces.

UNIT-V

Heat Exchangers: Classification and applications of heat exchangers in industry, Analysis and design of counter flow and parallel flow heat exchanger, Fouling factors, Solving problems for multi pass heat exchanger using non dimensional parameter plots.

Change or 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 :

1. Holman, J.P., *"Heat Transfer"*, McGraw Hill Publication, New Delhi, 2004
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, 2004
5. Arora, S.C. and Domkandwar., *"A course in Heat and Mass Transfer"*, Dhanpat Rai & Sons, New Delhi, 2004.

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 Ist- 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 week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

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

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

Air Refrigeration Systems : Analysis of Bell-Coleman Cycle, Reversed Brayton cycle, Open and Dense air system, Application to aircraft refrigeration, Simple cooling system, Bootstrap simple evaporating system, Regenerative cooling system and Reduced ambient cooling 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. 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 sys em, 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 beat on performance, ASHRE comfort chart, Effective temperature.

UNIT-V

Cooling Load Calculations in Air Conditioning: Concept of by pass factor, Sensible beat 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 A ir conditioning"*, Tata McGraw Hill, New Delhi, 2004.
2. Arora, S.C. and Domkundwar, S., *"A Course in Refrigeration and Air conditioning'*, Dhanpat Rai & Sons, New Delhi, 2004.
3. Jain, V.K., *"Refrigeration and Air Conditioning"*, S Chand & Company, New Delhi, 2004.
4. Stocker, W.S., *"Refrigeration and Air conditioning"*, McGraw Hill, New Delhi, 2004.

ME 381
METAL CUTTING AND 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. Grilling of flat surfaces using surface girding machine and measurement of surface finish.
12. Exposure to operations like trepanning, lapping, honing and broaching.

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 / I-DEAS / Solid works / MDT / Inventor / CATIA etc., for Geometric modeling