VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

III SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT31	Engg. Maths – III	Mathematics	04	--	03	25	100	125
2	10ME32A/10ME32B	Material Sc. & Metallurgy / Mechanical Measurements & Metrolgy	Mechanical	04	--	03	25	100	125
3	10ME33	Basic Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME34	Mechanics of Materials	Mechanical	04	--	03	25	100	125
5	10ME35	Manufacturing Process I	Mechanical	04	--	03	25	100	125
6	10ME36A/10ME36B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL37A/10MEL37B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL38A/10MEL38B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
III SEMESTER B.E. MECHANICAL				**21/24**	**9**	**24**	**200**	**700**	**900**

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

IV SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT41	Engg. Maths – IV	Mathematics	04	--	03	25	100	125
2	10ME42A/10ME42B	Material Sc. & Metallurgy / Mechanical Measurements & Metrolgy	Mechanical	04	--	03	25	100	125
3	10ME43	Applied Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME44	Kinematics of Machines	Mechanical	04	--	03	25	100	125
5	10ME45	Manufacturing Process II	Mechanical	04	--	03	25	100	125
6	10ME46A/10ME46B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL47A/10MEL47B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL48A/10MEL48B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
				21	**09**	**24**	**200**	**700**	**900**

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

V SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME51	Management and Entrepreneurship	04	--	03	25	100	125
2	10ME52	Design of Machine Elements I	04	--	03	25	100	125
3	10ME53	Energy Engineering	04	--	03	25	100	125
4	10ME54	Dynamics of Machines	04	--	03	25	100	125
5	10ME55	Manufacturing Process III	04	--	03	25	100	125
6	10ME56	Turbo Machines	04	--	03	25	100	125
7	10MEL57	Fluid Mechanics & Machines Lab	--	03	03	25	50	75
8	10MEL58	Energy Conversion Engg. Lab		03	03	25	50	75
			24	**06**	**24**	**200**	**700**	**900**

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VI SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME61	Computer Integrated Manufacturing	04	--	03	25	100	125
2	10ME62	Design of Machine Elements II	04	--	03	25	100	125
3	10ME63	Heat & Mass Transfer	04	--	03	25	100	125
4	10ME64	Finite Element Methods	04	--	03	25	100	125
5	10ME65	Mechatronics & □ P	04	--	03	25	100	125
6	10ME66X	Elective ‘A’	04	--	03	25	100	125
7	10MEL67	Heat & Mass Transfer Lab	--	03	03	25	50	75
8	10MEL68	CAMA Lab	--	03	03	25	50	75
			24	**06**	**24**	**200**	**700**	**900**

Elective ‘A’	
10ME661 Theory of Elasticity	10ME662 Mechanics of Composite Materials
10ME663 Refrigeration & Air Conditioning	10ME664 Design of Heat Exchangers
10ME665 Non Traditional Machining	10ME666 Knowledge Management
10ME667 Project Management	10ME668 Statistic Quality Control

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION VII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME71	Engineering Economics	04	--	03	25	100	125
2	10ME72	Mechanical Vibrations	04	--	03	25	100	125
3	10ME73	Hydraulics and Pneumatics	04	--	03	25	100	125
4	10ME74	Operations Research	04	--	03	25	100	125
5	10ME75X	Elective B	04	--	03	25	100	125
6	10ME76X	Elective C	04	--	03	25	100	125
7	10MEL77	Design Lab	--	03	03	25	50	75
8	10MEL78	CIM and Automation Lab	--	03	03	25	50	75
9	10MEL79	Project Phase I	--	--	--	50	--	50
			24	**06**	**24**	**250**	**700**	**950**

Elective 'B'		Elective 'C'	
10ME751 Mechanism Design	10ME752 Theory of Plasticity	10ME761 Experimental Stress Analysis	10ME762 Tool Design
10ME753 Engineering Design	10ME754 Non Conventional Energy Sources	10ME763 Cryogenics	10ME764 Smart Materials
10ME755 Gas Dynamics	10ME756 Management Information System	10ME765 Agile Manufacturing	10ME766 Robotics
10ME757 Automation in Manufacturing	10ME758 Total Quality Management	10ME767 Finance management	10ME768 Micro & Smart System Technology

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VIII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME81	Operations Management	04	--	03	25	100	125
2	10ME82	Control Engineering	04	--	03	25	100	125
3	10ME83X	Elective D	04	--	03	25	100	125
4	10ME84X	Elective E	04	--	03	25	100	125
5	10ME85L	Project Work	--	06	03	100	100	200
6	10ME86L	Seminar	--	03	--	50	--	50
				09	**15**	**250**	**500**	**750**

Elective 'D'		Elective 'E'	
10ME831 Tribology	10ME832 Fracture Mechanics	10ME841 Machine Tool Design	10ME842 Industrial Engineering & Ergonomics
10ME833 Power Plant Engineering	10ME834 Nano Technology	10ME843 Bio Mass Energy Systems	10ME844 Automotive Engineering
10ME835 Orgisational Behaviour and Professioanl Communication	10ME836 Computer Graphics	10ME845 Database Management System	10ME846 Artificial Intelligence
10ME837 Rapid Prototyping	10ME838 Foundry Technology	10ME847 Design of Experiments	10ME848 Design for Manufacture & Assembly

III Semester
MATERIAL SCIENCE AND METALLURGY

Sub Code	**: 10ME 32A /42A**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Crystal Structure: BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. Atomic Diffusion: Phenomenon, Flick's laws of diffusion, factors affecting diffusion.

06 Hours

UNIT - 2

Mechanical Behaviour: Stress-strain diagram showing ductile and brittle behaviour of materials, linear and non linear elastic behaviour and properties, mechanical properties in plastic range, yield strength offset yield strength, ductility, ultimate tensile strength, toughness. Plastic deformation of single crystal by slip and twinning.

06 Hours

UNIT - 3

Fracture: Type I, Type II and Type III.

Creep: Description of the phenomenon with examples. three stages of creep, creep properties, stress relaxation.

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram.

07 Hours

UNIT - 4

Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures.

Phase Diagram I: Solid solutions Hume Rothary rule substitutional, and interstitial solid solutions, intermediate phases, Gibbs phase rule.

07 Hours

PART - B

UNIT - 5

Phase Diagram II: Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Iron carbon equilibrium diagram description of phases, solidification of steels and cast irons, invariant reactions.

06 Hours

UNIT - 6

Heat treating of metals: TTT curves, continuous cooling curves, annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminium-copper alloys.

07 Hours

UNIT - 7

Ferrous and non ferrous materials: Properties, Composition and uses of

- Grey cast iron, malleable iron, SG iron and steel
- Copper alloys-brasses and bronzes.
  Aluminium alloys-Al-Cu,Al-Si,Al-Zn alloys.

06 Hours

UNIT - 8

Composite Materials: Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP' sand MMC's advantages and application of composites.

07 Hours

TEXT BOOKS:

1. **Foundations of Materials Science and Engineering,** Smith, 4th Edition McGraw Hill, 2009
2. **Materials Science, Shackleford., & M. K. Muralidhara,** Pearson Publication – 2007.

REFERENCE BOOKS:

1. **An Introduction to Metallurgy; Alan Cottrell**, University Press India Oriental Longman Pvt. Ltd., 1974.
2. **Engineering Materials Science**, W.C.Richards, PHI, 1965
3. **Physical Metallurgy**; Lakhtin, Mir Publications
4. **Materials Science and Engineering,** V.Raghavan , PHI, 2002
5. **Elements of Materials Science and Engineering,** H. VanVlack, Addison-Wesley Edn., 1998
6. **Materials Science and Engineering,**William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition, 2001.
7. **The Science and Engineering of Materials,** Donald R. Askland and Pradeep.P. Phule, Cengage Learning, 4th Ed., 2003.

MECHANICAL MEASUREMENTS AND METROLOGY

Sub Code	**: 10ME 32B / 42B**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks:**	**100**

PART- A

UNIT-1:

Standards of measurement: Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-12), Numerical problems on building of slip gauges.

06 Hours

UNIT-2:

System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

07 Hours

UNIT-3:

Comparators and Angular measurement: Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles, Zeiss ultra optimeter, electric and electronic comparators-principles, LVDT, pneumatic comparators, back pressure gauges, solex comparators. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numericals on building of angles), clinometers.

07 Hours

UNIT-4:

Interferometer and screw thread, gear measurement: Interferometer, interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Tool maker's microscope, gear tooth terminology, use of gear tooth vernier caliper and micrometer.

06 Hours

PART-B

UNIT-5:

Measurements and measurement systems: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysterisis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. **07 Hours**

UNIT-6:

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters. **06 Hours**

UNIT-7:

Measurement of force, torque and pressure: Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. **06 Hours**

UNIT-8:

Temperature and strain measurement: Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. **07 Hours**

TEXT BOOKS:

1. **Mechanical Measurements,** Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology,** R.K. Jain, Khanna Publishers, 1994.

REFERENCE BOOKS:

1. **Engineering Metrology,** I.C. Gupta, Dhanpat Rai Publications, Delhi.
2. **Mechanical Measurements,** R.K. Jain Khanna Publishers, 1994
3. **Industrial Instrumentation,** Alsutko, Jerry. D. Faulk, Cengage Asia Pvt. Ltd. 2002.
4. **Measurement Systems Applications and Design,** Ernest O. Doebelin, 5th Ed., McGraw Hill Book Co.
5. **Metrology & Measurement,** Anand K. Bewoor & Vinay A.

Kulkarni, Tata McGraw Hill Pvt. Ltd., New-Delhi

BASIC THERMODYNAMICS

(Commonto ME/IP/AU/IM/MA)

Sub Code	**: 10ME33**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART-A

UNIT - 1

Fndamental Concepts & Definitions: Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic preesses; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.

06 Hours

UNIT - 2

Work and Heat: Mechancis, defintion of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention.

06 Hours

UNIT - 3

First Law of Thermodynamics: Joules expriments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as filmg and evacuation of vessels with and without heat transfer.

07 Hours

UNIT - 4

Second Law of Thermodynamics: Devices converting heat to work; (a) in a thermodynacmic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat

engine; schematic representation and efficiency. Devices converting work to heat in a theromodynamic cycle; reversed heat engine, schematic representation, coefficients of performace. Keivin - Planck statement of the Secnd law of Thermodynamics; PMM I and PMM II, Clasius statement of Second law of Thermodynamics,Equivalence of the two statements; Reversible and irrevesible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.

07 Hours

PART-B

UNIT - 5

Entropy: Clasius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

06 Hours

UNIT - 6

Pure Substances: P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

07 Hours

UNIT - 7

Thermodynamic relations: Maxwell relation, Causius Clayperon's equation. Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and partiuclar gas constans, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy. enthalpy and entropy in various quasi-static processes.

07 Hours

UNIT - 8

Ideal gas mixture : Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of properties, Analysis of various process. Real Gases: Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressiblity factor; compressibility chart

06 Hours

Data Handbooks :

1. **Thermodynomic data hand book,** B.T. Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroiya, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOKS:

1. **Basic Engineering Thermodynamics,** A.Venkatesh, University Press, 2008
2. **Basic and Applied Thermodynamics,** P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

REFERENCE BOOKS:

1. **Thermodynamcis**, An Engineering Approach, Yunus A.Cenegal and Michael A.Boles, Tata McGraw Hill publications, 2002
2. **Engineering Thermodynamics**, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
3. **Fundamentals of Classical Thermodynamics**, G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.
4. **An Introduction to Thermodynamcis**, Y.V.C.Rao, Wiley Eastern, 1993,
5. **B.K Venkanna, Swati B. Wadavadagi "Basic Thermodynomics,** PHI, New Delhi, 2010

MECHANICS OF MATERIALS

Sub Code	**: 10ME34**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks:**	**100**

PART-A

UNIT 1:

Simple Stress and Strain: Introduction, Stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation - behaviour in tension for Mild steel, cast iron and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position.

07 Hours

UNIT 2:

Stress in Composite Section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

06 Hours

UNIT 3:

Compound Stresses: Introduction, Plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

07 Hours

UNIT 4:

Energy Methods: Work and strain energy, Strain energy in bar/beams, Castiglinios theorem, Energy methods.
Thick and Thin Cylinder Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lame's equation (compound cylinders not included).

06 Hours

PART-B

UNIT 5:

Bending Moment and Shear Force in Beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.

07 Hours

UNIT 6:

Bending and Shear Stresses in Beams: Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress, radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. (composite / notched beams not included).

07 Hours

UNIT 7:

Deflection of Beams: Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple. Macaulay's method

06 Hours

UNIT 8:

Torsion of Circular Shafts and Elastic Stability of Columns:
Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts

Columns: Euler's theory for axially loaded elastic long columns. Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.

06 Hours

TEXT BOOKS:

1. **"Mechanics of Materials",** by R.C.Hibbeler, Prentice Hall. Pearson Edu., 2005
2. **"Mechanics of materials",** James.M.Gere, Thomson, Fifth edition 2004.
3. **"Mechanics of materials",** in SI Units, Ferdinand Beer & Russell Johston, 5th Ed., TATA McGraw Hill- 2003.

REFERENCE BOOKS:

1. **"Strength of Materials",** S.S. Rattan, Tata McGraw Hill, 2009
2. **"Strength of Materials",** S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.
3. **"Mechanics of Materials",** K.V. Rao, G.C. Raju, First Edition, 2007
4. **"Engineering Mechanics of Solids**", Egor.P. Popov, Pearson Edu. India, 2nd, Edison, 1998.
5. **"Strength of Materials",** W.A. Nash, 5th Ed., Sehaum's Outline Series, Fourth Edition-2007.

MANUFACTURING PROCESS – I

(FUNDAMENTALS OF FOUNDRY & WELDING)

Sub Code	**: 10ME35**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART – A

CASTING PROCESS

UNIT 1

Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS color coding of Patterns.

Binder: Definition, Types of binder used in moulding sand.
Additives: Need, Types of additives used and their properties..

06 Hours

UNIT 2

Sand Moulding : Types of base sand, requirement of base sand. Moulding sand mixture ingredients for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds.

Cores: Definition, Need, Types. Method of making cores, Binders used, core sand moulding.

Concept of Gating & Risers. Principle and types.

Fettling and cleaning of castings. Basic steps, Casting defects, Causes, features and remedies.

Moulding Machines : Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.

07 Hours

UNIT 3

Special moulding Process: Study of important moulding processes, No bake moulds, Flaskless moulds, Sweep mould, CO_2 mould, Shell mould, Investment mould.

Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.

07 Hours

UNIT 4

Melting Furnaces: Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace.

06 Hours

PART – B

WELDING

UNIT 5

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding.

Arc Welding: Principle, Metal Arc welding **(MAW)**, Flux Shielded Metal Arc Welding **(FSMAW)**, Inert Gas Welding **(TIG & MIG)** Submerged Arc Welding **(SAW)** and Atomic Hydrogen Welding processes. **(AHW)**

Gas Welding: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gas torch construction & working. Forward and backward welding.

07 Hours

UNIT 6

Special types of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding.

Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

07 Hours

UNIT 7

Metallurgical aspect, in welding : Structure of welds, Formation of different zones during welding. Heat affected zone **(HAZ).** Parameters affecting **HAZ**. Effect of carbon content on structure and properties of steel. Shrinkage in welds & Residual stresses.

Concept of electrodes, Filler rod and fluxes. Welding defects – Detection causes & remedy.

06 Hours

UNIT 8

Principles of soldering & brazing: Parameters involved & Mechanism. Different Types of Soldering & Brazing Methods.

Inspection Methods – Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection.

06 Hours

TEXT BOOKS:

1. **"Manufacturing Process-I",** Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2009.
2. **"Manufacturing & Technology**: Foundry Forming and Welding", P.N.Rao, 3rd Ed., Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. **"Process and Materials of Manufacturing**", Roy A Lindberg, 4th Ed. Pearson Edu. 2006.
2. **"Manufacturing Technology**", Serope Kalpakjain, Steuen. R. Sechmid, Pearson Education Asia, 5th Ed. 2006.

COMPUTER AIDED MACHINE DRAWING

Sub Code	**: 10ME36A / 10ME46A**	**IA Marks**	**: 25**
Hrs/week	**: 04(1 Hrs. Theory & 2 Hrs Practical)**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

Introduction:

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap.

02 Hours

PART-A

UNIT 1:

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections.

Orthographic Views: Conversion of pictorial views into orthographic projections. of **simple machine parts** with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.

08 Hours

UNIT 2:

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

08 Hours

PART-B

UNIT 3:

Keys & Joints :

Parallel key, Taper key, Feather key, Gibhead key and Woodruff key

Riveted Joints: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

08 Hours

UNIT 4:

Couplings:
Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)

08 Hours

PART - C
Assembly Drawings
(Part drawings should be given)

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Tool Head of a shaper

18 Hours

TEXT BOOKS:

1. **'A Primer on Computer Aided Machine Drawing-2007'**, Published by VTU, Belgaum.
2. **'Machine Drawing'**, N.D.Bhat & V.M.Panchal

REFERENCE BOOKS:

1. **'A Text Book of Computer Aided Machine Drawing'**, S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007
2. **'Machine Drawing'**, K.R. Gopala Krishna, Subhash Publication.
3. **'Machine Drawing with Auto CAD**', Goutam Pohit & Goutham Ghosh, 1st Indian print Pearson Education, 2005
4. **'Auto CAD 2006, for engineers and designers'**, Sham Tickoo. Dream tech 2005
5. **'Machine Drawing'**, N. Siddeshwar, P. Kanniah, V.V.S. Sastri, published by Tata McGraw Hill,2006

NOTE:

Internal assessment: 25 Marks

All the sheets should be drawn in the class using software. Sheet sizes should be A3/A4. All sheets must be submitted at the end of the class by taking printouts.

Scheme of Examination:

Two questions to be set from each Part-A, Part-B and Part-C
Student has to answer one question each from Part-A and Part-B for 20 marks each. And one question from Part-C for 60 marks.

i.e.	**PART-A 1 x 20**	**= 20 Marks**
	PART-B 1 x 20	**= 20 Marks**
	PART-C 1 x 60	**= 60 Marks**
	Total	**= 100 Marks**

FLUID MECHANICS

Sub Code	**: 10ME 36B / 46B**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART – A

UNIT-1

Properties of Fluids: Introduction, Types of fluid, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation

06 Hours

UNIT-2

Fluid Statistics : Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.

07 Hours

UNIT-3

Buoyancy and Fluid Kinematics:
Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically.
Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Carversian Co-ordinates only, velocity and acceleration, velocity potential function and stream function.

07 Hours

UNIT-4

Fluid Dynamics: Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.

06 Hours

PART-B

UNIT-5

Fluid Flow Measurements : Venturimeter, orificemeter, pitot-tube, vertical orifice, V-Notch and rectangular notches.
Dimensional Analysis : Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham π theorem, dimensionless numbers, similitude, types of similtudes.

07 Hours

UNIT-6

Flow through pipes : Minor losses through pipes. Darey's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL.

06 Hours

UNIT-7

Laminar flow and viscous effects : Reyonold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseille's equation, laminar flow between parallel and stationary plates.

06 Hours

UNIT-8

Flow past immersed bodies : Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness.
Introduction to compressible flow : Velocity of sound in a fluid, Mach nuber, Mach cone, propagation of pressure waves in a compressible fluid.

07 Hours

TEXT BOOKS:

1. **Fluid Mechanics,** Oijush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
2. **Fluid Mechanics**, Dr. Bansal, R.K.Lakshmi Publications, 2004.

REFERENCE BOOKS:

1. **Fluid Mechanics and hydraulics,** Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997.
2. **Fluid Mechanics (SI Units),** Yunus A. Cengel John M.Oimbala, 2nd Ed., Tata McGraw Hill, 2006.

3. **Fluid Mechanics,** John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006
4. **Fluid Mechanics and Fluid Power Engineering**, Kumar.D.S, Kataria and Sons., 2004
5. **Fluid Mechanics** -. Merle C. Potter, Elaine P.Scott. Cengage learning

METALLOGRAPHY AND MATERIAL TESTING LABORATORY

Sub Code	**: 10MEL 37A / 47A**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 48**	**Exam Marks**	**: 50**

PART – A

1. Preparation of specimen for Metallograpic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.
3. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
4. Non-destructive test experiments like,
   (a). Ultrasonic flaw detection
   (b). Magnetic crack detection
   (c). Dye penetration testing. To study the defects of Cast and Welded specimens

PART – B

1. Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine
2. Torsion Test
3. Bending Test on metallic and nonmetallic specimens.
4. Izod and Charpy Tests on M.S, C.I Specimen.
5. Brinell, Rockwell and Vickers's Hardness test.
6. Fatigue Test.

Scheme of Examination:

ONE question from part -A:	**20** Marks
ONE question from part -B:	**20** Marks
Viva -Voice:	**10** Marks
Total :	**50** Marks

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY

Sub Code	**: 10MEL 37B / 47B**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 48**	**Exam Marks**	**: 50**

PART-A: MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART-B: METROLOGY

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
    a) Lathe tool Dynamometer
    b) Drill tool Dynamometer.
5. Measurement of Screw thread Parameters using Two wire or Three-wire method.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

Scheme of Examination:

ONE question from part -A:	**20** Marks
ONE question from part -B:	**20** Marks
Viva -Voice:	**10** Marks
Total :	**50** Marks

FOUNDRY AND FORGING LABORATORY

Sub Code	**: 10MEL 38A / 48A**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 48**	**Exam Marks**	**: 50**

PART – A

1. Testing of Moulding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

1 Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2 Permeability test
3 Core hardness & Mould hardness tests.
4 Sieve Analysis to find Grain Finest number of Base Sand
5 Clay content determination in Base Sand

PART – B

2. Foundry Practice

Use of foundry tools and other equipments.
Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).
Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART – C

3. Forging Operations :

- Calculation of length of the raw material required to do the model.

- Preparing minimum three forged models involving upsetting, drawing and bending operations.
- Out of these three models, at least one model is to be prepared by using Power Hammer.

Scheme of Examination:

One question is to be set from Part-A: 10 marks

One question is to be set from either

Part-B or Part-C: 30 marks

Calculation part in case of forging is made compulsory

Calculation (Forging)	+ Foundry Model	= 05 +25 = 30 Marks
Calculation (Forging)	+ Forging Model	= 05 +25 = 30 Marks

Viva-Voce : 10 marks.

Total : 50 Marks**.**

MACHINE SHOP

Sub Code	**: 10MEL 38A / 48A**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 48**	**Exam Marks**	**: 50**

PART – A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART – B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
Cutting of Gear Teeth using Milling Machine.

Scheme of Examination:

ONE question from part -A: **30** Marks

ONE question from part -B: **10** Marks

Viva -Voice: **10** Marks

Total : 50 Marks

APPLIED THERMODYNAMICS

Sub Code	**: 10ME43**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks:**	**100**

PART-A

Unit 1:

Combustion thermodynamics: Theoretical (Stoichiometric) air and excess air for combustion of fuels. Mass balance, actual combustion. Exhaust gas analysis. A./ F ratio, Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, Combustion efficiency, adiabatic flow temperature.

07 Hours

Unit 2:

Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles.

06 Hours

Unit 3:

I.C. Engine: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.

06 Hours

Unit 4:

Vapour Power Cycles: Carnot vapour power cycles, drawbacks as a reference cycle, Simple Rankine cycle, description, T- S diagram, analysis for performance , comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycle, open and closed feed water heaters, Reheat Rankine cycle.

07 Hours

PART-B

Unit 5:

Reciprocating Compressors: Operation of a single stage reciprocating compressors, work input through P-V diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multistage compressor, saving in work,

optimum intermediate pressure, inter- cooling, minimum work for compression.

06 Hours

Unit 6:

Gas turbine and Jet propulsion: Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency, Jet propulsion and Rocket propulsion.

07 Hours

Unit 7

Refrigeration: Vapour compression refrigeration system ; description, analysis, refrigerating effect, capacity , power required, units of refrigeration, COP , Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system, steam jet refrigeration.

06 Hours

Unit 8

Psychrometry: Atmospheric air and psychrometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidifies and the relation between the two enthalpy and adiabatic saturation temperature. Construction and use of psychrometric chart . Analysis of various processes; heating, cooling , dehumidifying and humidifying. Adiabatic mixing of moist air. Summer and winter air conditioning.

07 Hours

Data Hand Book :

1. **Thermodynomic data hand book,** B.T. Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroiya, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOK

1. **Basic and applied Thermodynamics**, P.K. Nag, 2nd Ed., Tata McGraw Hill Pub.Co,2002
2. **Applied Thermodynamics**, Rajput, Laxmi Publication
3. **Applied Thermodynamics**, B.K. Venkahna, Swati B. Wadavadagi, PHI, New Delhi, 2010

REFERENCE BOOKS

1. **Thermodynamics , An engineering approach**, Yunus, A. Cengel and Michael A.Boies, 6th Ed., Tata McGraw Hill pub. Co., 2002,

2. **Fundamental of Classical Thermodynamics,** G.J. Van Wylen and R.E. Sontang Wiley eastern.

KINEMATICS OF MACHINES

Sub Code	**: 10ME44**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT 1:

Introduction: Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine.
Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

07 Hours

UNIT 2:

Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.
Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

06 Hours

UNIT 3:

Velocity and Acceleration Analysis of Mechanisms (Graphical Methods) Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles .in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

07 Hours

UNIT 4:

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method
Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

06 Hours

PART - B

UNIT 5:

Velocity and Acceleration Analysis of Mechanisms (Analytical Methods): Analysis of four bar chain and slider crank chain using analytical expressions. (Use of complex algebra and vector algebra)

06 Hours

UNIT 6:

Spur Gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification.

07 Hours

UNIT 7:

Gear Trains: Simple gear trains, Compound gear trains for large speed. reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

07 Hours

UNIT 8:

Cams: Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

06 Hours

TEXT BOOKS:

1. **"Theory of Machines",** Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines",** Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms**", J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambekar, PHI, 2007

Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself.

MANUFACTURING PROCESS – II
(Metal Removing Process)

Sub Code	**: 10ME45**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART – A

UNIT - 1

Theory of Metal Cutting: Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation, Types of Chips. Merchants circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis. Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.

07 Hours

UNIT - 2

Cutting Tool Materials: Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip. Measurement of tool tip temperature.

07 Hours

UNIT - 3

Turning (Lathe), Shaping and Plaining Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Plaining Machine, Driving mechanisms of lathe, shaping and plaining machines, Different operations on lathe, shaping machine and plaining machine. Simple problems on machining time calculations

07 Hours

UNIT - 4

Drilling machines: Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials.

Introduction to CNC machines- Principles of operation. Axes of NC machine-Coordinate systems. Basics of Manual part programming methods.

06 Hours

PART – B

UNIT - 5

Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations.

Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.

06 Hours

UNIT - 6

Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centerless, cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters. Dressing and truing of grinding wheels.

07 Hours

UNIT - 7:

Broaching process - Principle of broaching. Details of a broach. Types of broaching machines-constructional details. Applications. Advantages and Limitations.

Finishing and other Processes Lapping and Honing operations – Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application.

06 Hours

UNIT - 8

Non-traditional machining processes: Need for non traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.

06 Hours

Text Books:

1. **Workshop Technology,** Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. **Production Technology,** R.K.Jain, Khanna Publications, 2003.
3. **Production Technology,** HMT, Tata Mc Graw Hill, 2001.

Reference Books:

1. **Manufacturing Science**, Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. **Fundamentals of Metal Machining and Machine Tools,** G. Boothroyd, McGraw Hill, 2000.

MANAGEMENT AND ENTREPRENEURSHIP

Sub Code	**: 10AL 51**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART – A

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modem management approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans.

6 Hours

UNIT - 3

ORGANIZING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees- Centralization Vs Decentralization of authority. and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing--:Process of Selection & Recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co - Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief):

7 Hours

PART-B

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers.

6 Hours

UNIT – 6

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only)

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

7 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

7 Hours

TEXT BOOKS:

1. **Principles of Management –** P. C.Tripathi, P.N. Reddy – Tata McGraw Hill,

2. **Dynamics of Entrepreneurial Development & Management** Vasant Desai - Himalaya Publishing House

3. **Entrepreneurship Development** – Poornima. M. Charantimath Small Business Enterprises - Pearson Education - 2006 (2 & 4).

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development - Robers Lusier - Thomson

2. **Entrepreneurship Development** - S.S.Khanka - S.Chand & Co.

3. **Management** - Stephen Robbins - Pearson Education/PHI - 17th Edition, 2003.

DESIGN OF MACHINE ELEMENTS-I

Sub Code	**: 10ME 52**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT- 1

Introduction: Definitions: normal, shear, biaxial and tri axial stresses, Stress tensor, Principal Stresses. Engineering Materials and their mechanical properties, Stress-Strain diagrams, Stress Analysis, Design considerations: Codes and Standards.

05 Hours

UNIT- 2

Design For Static & Impact Strength:

Static Strength: Static loads and factor of safety, Theories of failure: Maximum normal stress theory, Maximum shear stress theory, Maximum strain theory, Strain energy theory, Distortion energy theory. Failure of brittle and ductile materials, Stress concentration, Determination of Stress concentration factor.

Impact Strength: Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia.

07 Hours

UNIT - 3

Design For Fatigue Strength: Introduction- S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Modifying factors: size effect, surface effect, Stress concentration effects, Fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

08 Hours

UNIT - 4

Threaded Fasteners: Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static, dynamic and impact loads, Design of eccentrically loaded bolted joints.

06 Hours

PART - B

UNIT - 5

Design Of Shafts: Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under fluctuating loads and combined loads.

07 Hours

UNIT - 6

Cotter And Knuckle Joints, Keys And Couplings: Design of Cotter and Knuckle joints, Keys: Types of keys, Design of keys, Couplings: Rigid and

flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling.

07 Hours

UNIT - 7

Riveted and Welded Joints – Types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets. Welded Joints – Types, Strength of butt and fillet welds, eccentrically loaded welded joints.

07 Hours

UNIT - 8

Power Screws: Mechanics of power screw, Stresses in power screws, efficiency and self-locking, Design of Power Screw, Design of Screw Jack: (Complete Design).

05 Hours

TEXT BOOKS

1. **Mechanical Engineering Design,** Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2009.
2. **Design of Machine Elements,** V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

DESIGN DATA HANDBOOK

1. **Design Data Hand Book,** K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book,** K. Mahadevan and Balaveera Reddy, CBS Publication
3. **Design Data Hand Book,** H.G. Patil, I. K. International Publisher, 2010.

REFERENCE BOOKS

1. **Machine Design,** Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements,** M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design,** Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Fundamentals of Machine Component Design,** Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.

ENERGY ENGINEERING

Sub Code	**: 10ME 53**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Steam Power Plant: Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, strokers, different types, Oil burners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures.

07 Hours

UNIT - 2

A Brief Account Of Benson, Velox Schmidt Steam Generators. Chimneys: Natural, forced, induced and balanced draft, Calculations and numericals involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air pre-heaters and re-heaters.

07 Hours

UNIT - 3

Diesel Engine Power Plant: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.

06 Hours

UNIT - 4

Hydro-Electric Plants: Hydrographs, flow duration and mass curves, unit hydrograph and numericals. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

06 Hours

PART - B

UNIT - 5

Nuclear Power Plant: Principles of release of nuclear energy; Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the nuclear reactor; moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types-Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shieldings, Radio active waste disposal.

06 Hours

UNIT - 6

Solar Energy: Solar Extra terrestrial radiation and radiation at the earth surface, radiation-measuring instruments, working principles of solar flat plate collectors, solar pond and photovoltaic conversion (Numerical Examples).

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

08 Hours

UNIT - 7

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

Ocean Thermal Energy Conversion: Principle of working, Rankine cycle, problems associated with OTEC.

Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, problems associated with geothermal conversion, scope of geothermal energy.

06 Hours

UNIT - 8

Energy From Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation.

Bio Chemical Route: Biogas production from organic wastes by anaerobic fermentation, classification of bio gas plants, factors affecting bio gas generation.

Thermo Chemical Route: Thermo chemical conversion on bio mass, types of gasifiers.

06 Hours

TEXT BOOKS:

1. **Power Plant Engineering**, P. K. Nag Tata McGraw Hill 2nd edn 2001.
2. **Power Plant Engineering,** Domakundawar, Dhanpath Rai sons. 2003

REFERENCE BOOKS:

1. **Power Plant Engineering,** R. K. Rajput, Laxmi publication, New Delhi.
2. **Principles of Energy conversion**, A. W. Culp Jr., McGraw Hill. 1996

3. **Non conventional Energy sources**, G D Rai Khanna Publishers.
4. **Non conventional resources,** B H Khan TMH - 2007

DYNAMICS OF MACHINES

Sub Code	**: 10ME 54**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT 1: Static Force Analysis: Introduction: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque. Free body diagrams. Principle of virtual work. Static force analysis of four bar mechanism and slider-crank mechanism with and without friction.

06 Hours

UNIT 2: Dynamic Force Analysis: D'Alembert's principle, Inertia force, inertia torque. Dynamic force analysis of four-bar mechanism and slider crank mechanism. Dynamically equivalent systems. Turning moment diagrams and flywheels. Fluctuation of Energy. Determination of size of flywheels.

08 Hours

UNIT 3: Friction and Belt Drives: Definitions: Types of friction: laws of friction, Friction in pivot and collar bearings. Belt drives: Flat belt drives. ratio of belt tensions, centrifugal tension, power transmitted.

06 Hours

UNIT 4: Balancing of Rotating Masses: Static and dynamic balancing. Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

06 Hours

PART - B

UNIT 5: Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, single cylinder engine, balancing in multi cylinder-inline engine (primary & secondary forces), V-type engine; Radial engine – Direct and reverse crank method.

08 Hours

UNIT 6: Governors: Types of governors; force analysis of Porter and Hartnell governors. Controlling force. stability, sensitiveness. Isochronism, effort and power,

06 Hours

UNIT 7: Gyroscope: Vectorial representation of angular motion. Gyroscopic couple. Effect of gyroscopic couple on ship, plane disc, aeroplane, stability of two wheelers and four wheelers.

06 Hours

UNIT 8: Analysis of Cams: Analysis of Tangent cam with roller follower and Circular arc cam operating flat faced and roller followers. Undercutting in Cams

06 Hours

TEXT BOOKS:

1. **Theory of Machines**, Sadhu Singh, Pearson Education. 2nd edition. 2007.
2. **Theory of Machines**, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms",** J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009
2. **Mechanism and Machine Theory**, A.G.Ambekar PHI, 2007

MANUFACTURING PROCESS – III

(METAL FORMING PROCESS)

Sub Code	**: 10ME 55**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction And Concepts: Classification of metal working processes, characteristics of wrought products, advantages and limitations of metal working processes.Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress. Principal stresses, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain.

07 Hours

UNIT - 2

Effects Of Parameters: Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

06 Hours

UNIT - 3

Forging: Classification of forging processes. Forging machines & equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging. Forging defects, Residual stresses in forging. Simple problems.

07 Hours

UNIT - 4

Rolling: Classification of Rolling processes. Types of rolling mills, expression for RoIling load. Roll separating force. Frictional losses in bearing, power required in rolling, Effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables, simple problems.

06 Hours

PART - B

UNIT - 5

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing, simple problems.

07 Hours

UNIT - 6

Extrusion: Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, Extrusion of seamless tubes. Extrusion variables, simple problem

06 Hours

UNIT - 7

Sheet & Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, Forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring, Simple problems

06 Hours

UNIT - 8

High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations.

07 Hours

TEXT BOOKS:

1. **Mechanical metallurgy (SI units),** G.E. Dieter, Mc Graw Hill pub.2001
2. **Manufacturing Process – III,** Dr. K.Radhakrishna, Sapna Book House, 2009.

REFERENCE BOOKS:

1. **Materials and Processes in Manufacturing,** E.paul, Degramo, J.T. Black, Ronald, A.K. Prentice -hall of India 2002
2. **Principles of Industrial metal working process,** G.W. Rowe, CBSpub. 2002
3. **Manufacturing Science,** Amitabha Ghosh & A.K. Malik - East - Westpress 2001
4. **Technology of Metal Forming Process**, Surendra kumar, PHI – 2008

TURBO MACHINES

Sub Code	**: 10ME 56**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART- A

UNIT -1

Introduction: Definition of turbomachine, parts of turbomachines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynold's number, Unit and specific quantities, model studies. Application of first and second law's of thermodynamics to turbomachines, Efficiencies of turbomachines. Problems.

07 Hours

UNIT – 2

Thermodynamics of fluid flow: Static and Stagnation states-Incompressible fluids and perfect gases, Overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process.

07 Hours

UNIT – 3

Energy exchange in Turbomachines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction,

utilization factor, Relation between degree of reaction and Utilization factor, Problems.

06 Hours

UNIT – 4

General Analysis of Turbomachines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

06 Hours

PART - B

UNIT – 5

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor, Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.

07 Hours

UNIT – 6

Hydraulic Turbines: Classification, Different efficiencies, Pelton turbine – velocity triangles, design parameters, Maximum efficiency. Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. Kaplan and Propeller turbines - velocity triangles, design parameters. Problems.

07 Hours

UNIT – 7

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

06 Hours

UNIT – 8

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems.

Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

06 Hours

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.**)**

TEXT BOOKS:

1. **An Introduction to Energy Conversion**, Volume III, Turbo machinery, **V**. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. **Turbines, Compressors & Fans**, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS:

1. **Principals of Turbomachines**, D. G. Shepherd, The Macmillan Company (1964).
2. **Fluid Mechanics & Thermodynamics of Turbomachines**, S. L. Dixon, Elsevier (2005).
3. **Turbomachine**, B.K.Venkanna PHI, New Delhi 2009.
4. **Text Book of Turbomachines,** M. S. Govindgouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

FLUID MECHANICS AND MACHINES LABORATORY

Sub Code	**: 10MEL 57**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 42**	**Exam Marks**	**: 50**

PART - A

1. Determination of coefficient of friction of flow in a pipe.

2. Determination of minor losses in flow through pipes.

3. Determination of force developed by impact of jets on vanes.

4. Calibration of flow measuring devices
   a. Orifice Plate meter
   b. Nozzle
   c. Venturimeter
   d. V-notch

18 Hours

PART - B

5. Performance testing of Turbines
   a. Pelton wheel
   b. Francis Turbine
   c. Kaplan Turbines

6. Performance testing of Pumps
   a. Single stage / Multi stage centrifugal pumps
   b. Reciprocating pump

7. Performance test of a two stage Reciprocating Air Compressor

8. Performance test on an Air Blower

24 Hours

Scheme for Examination:

One Question from Part A	-	15 Marks (05 Writeup + 10)
One Question from Part B	-	25 Marks (05 Writeup + 20)
Viva-Voce	-	10 Marks

Total		**50 Marks**

ENERGY CONVERSION ENGINEERING LABORATORY

Sub Code	**: 10MEL 58**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 42**	**Exam Marks**	**: 50**

PART - A

1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleavland's (Open Cup) Apparatus.

2. Determination of Calorific value of solid, liquid and gaseous fuels.

3. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.

4. Valve Timing/port opening diagram of an I.C. engine (4 stroke/2 stroke).

5. Use of planimeter

21 Hours

PART - B

1. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio heat balance sheet for

   (a) Four stroke Diesel Engine

   (b) Four stroke Petrol Engine

   (c) Multi Cylinder Diesel/Petrol Engine, (Morse test)

   (d) Two stroke Petrol Engine

   (e) Variable Compression Ratio I.C. Engine.

21 Hours

Scheme for Examination:

One Question from Part A	-	15 Marks (05 Writeup+10)
One Question from Part B	-	25 Marks (05 Writeup+20)
Viva-Voce	-	10 Marks

Total		**50 Marks**

COMPUTER INTEGRATED MANUFACTURING

Sub Code	**: 10ME 61**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART-A

UNIT - 1

Computer Integrated Manufacturing Systems: Introduction, Automation definition, Types of automation, CIM, processing in manufacturing, Production concepts, Mathematical Models-Manufacturing lead time, production rate, components of operation time, capacity, Utilization and availability, Work-in-process, WIP ratio, TIP ratio, Problems using mathematical model equations.

8 Hours

UNIT - 2

High Volume Production System: Introduction Automated flow line-symbols, objectives, Work part transport-continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam,. roller chain drive, Rotary-rack and pinion, Rachet & Pawl, Geneva wheel, Buffer storage, control functions-sequence, safety, Quality, Automation for machining operation.

6 Hours

UNIT - 3

Analysis Of Automated Flow Line & Line Balancing: General terminology and analysis, Analysis of Tranfer Line without storage upper bound approach, lower bound approach and problems, Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with simple problem, Partial automation-with numerical problems, flow lines with more than two stages, Manual Assembly lines, line balancing problem.

6 Hours

UNIT - 4

Minimum Rational Work Element: Work station process time, Cycle time, precedence constraints. Precedence diagram, Balance delay methods of line balancing-largest Candidate rule, Kilbridge and Westers method, Ranked positional weight method, Numerical problems covering L above methods and computerized line balancing.

6 Hours

PART-B

UNIT - 5

Automated Assembly Systems: Design for automated assembly systems, types of automated assembly system, Parts feeding devices-elements of parts delivery system-hopper, part feeder, Selectors, feed back, escapement and placement analysis of Multistation Assembly Machine analysis of single station assembly. **Automated Guided Vehicle System:** Introduction,

Vehicle guidance and routing, System management, Quantitative analysis of AGV's with numerical problems and application.

8 Hours

UNIT - 6

Computerized Manufacturing Planning System: Introduction, Computer Aided Process Planning, Retrieval types of process planning, Generative type of process planning, Material requirement planning, Fundamental concepts of MRP inputs to MRP, Capacity planning.

6 Hours

UNIT - 7

Cnc Machining Centers: Introduction to CNC, elements of CNC, CNC machining centers, part programming, fundamental steps involved in development of part programming for milling and turning.

6 Hours

UNIT - 8

Robotics: Introduction to Robot configuration, Robot motion, programming of Robots end effectors, Robot sensors and Robot applications.

6 Hours

TEXT BOOKS:

2. **Automation, Production system & Computer Integrated manufacturing,** M. P. Groover Person India, 2007 2nd edition.
3. **Principles of Computer Integrated Manufacturing**, S. Kant Vajpayee, Prentice Hall India.

REFERENCE BOOKS:

1. **Computer Integrated Manufacturing**, J. A. Rehg & Henry. W. Kraebber.
2. ***CADlCAM*** by Zeid, Tata McGraw Hill.

DESIGN OF MACHINE ELEMENTS – II

Sub Code	**: 10ME 62**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links

Cylinders & Cylinder Heads: Review of Lame's Equations; compound cylinders, stresses due to different types of fits, cylinder heads, flats.

08 Hours

UNIT - 2

Belts Ropes and Chains: Flat belts: Length & cross section, Selection of V-belts, ropes and chains for different applications.

05 Hours

UNIT - 3

Springs: Types of springs - stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Leaf Springs: Stresses in leaf springs. Equalized stresses, Energy stored in springs, Torsion, Belleville and Rubber springs.

08 Hours

UNIT - 4

Spur & Helical Gears: Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load. Helical Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads.

07 Hours

PART - B

UNIT - 5

Bevel and Worm Gears: Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads. Worm Gears: Definitions, Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

07 Hours

UNIT - 6

Clutches & Brakes: Design of Clutches: Single plate, multi plate and cone clutches. Design of Brakes: Block and Band brakes: Self locking of brakes: Heat generation in Brakes.

05 Hours

UNIT - 7

Lubrication and Bearings: Lubricants and their properties, Mechanisms of Lubrication bearing modulus, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated, Bearing Materials, Examples of journal bearing and thrust bearing design.

07 Hours

UNIT - 8

IC Engine Parts: Design of piston, connecting rod and crank shaft.

05 Hours

DESIGN DATA HANDBOOK

1. **Design Data Hand Book** , K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book,** K. Mahadevan and Balaveera Reddy, CBS Publication

3. **Design Data Hand Book,** H.G. Patil, I. K. International Publisher, 2010.

TEXT BOOKS

1. **Mechanical Engineering Design,** Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.
2. **Design of Machine Elements,** V. B Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007

REFERNCE BOOKS

1. **Machine Design,** Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements,** M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design,** Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Machine Design,** A CAD Approach: Andrew D DIMAROGONAS, John Wiley Sons, Inc, 2001.

HEAT AND MASS TRANSFER

Sub Code	**: 10ME 63**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introductory Concepts And Definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer; combined heat transfer mechanism. Boundry conditions of 1st, 2nd and 3rd Kind

Conduction: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems (No derivation). One dimensional conduction equations in rectangular, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. Thermal contact resistance.

07 Hours

UNIT - 2

Variable Thermal Conductivity: Derivation for heat flow and temperature distribution in plane wall. Critical thickness of insulation without heat generation, Thermal resistance concept & its importance. Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Numerical problems.

06 Hours

UNIT - 3

One-Dimensional Transient Conduction: Conduction in solids with negligible internal temperature gradient (Lumped system analysis), Use of Transient temperature charts (Heisler's charts) for transient conduction in slab, long cylinder and sphere; use of transient temperature charts for transient conduction in semi-infinite solids. Numerical Problems.

06 Hours

UNIT - 4

Concepts And Basic Relations In Boundary Layers: Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow discussion only). Numericals based on empirical relation given in data handbook.

Free Or Natural Convection: Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations of free convection in vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres, Numerical problems.

07 Hours

PART - B

UNIT - 5

Forced Convections: Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct, use of correlations for flow over a flat plate, over a cylinder and sphere. Numerical problems.

06 Hours

UNIT - 6

Heat Exchangers: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD, Effectiveness-NTU methods of analysis of heat exchangers. Numerical problems.

06 Hours

UNIT - 7

Condensation And Boiling: Types of condensation (discussion only) Nusselt's theory for laminar condensation on a vertical flat surface; use of correlations for condensation on vertical flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; regimes of pool boiling, pool boiling correlations. Numerical problems. Mass transfer definition and terms used in mass transfer analysis, Ficks First law of diffusion (no numericals).

07 Hours

UNIT - 8

Radiation Heat Transfer: Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's law and Wein's displacement law. Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; effect of radiation shield; intensity of radiation and solid angle; Lambert's law; radiation heat exchange between two finite surfaces-configuration factor or view factor. Numerical problems.

07 Hours

TEXT BOOKS:

1. **Heat & Mass transfer,** Tirumaleshwar, Pearson education 2006
2. **Heat transfer-A basic approach,** Ozisik, Tata McGraw Hill 2002

REFERENCE BOOKS:

1. **Heat transfer, a practical approach,** Yunus A- Cengel Tata Mc Graw Hill
2. **Principles of heat transfer,** Kreith Thomas Learning 2001
3. **Fundamentals of heat and mass transfer,** Frenk P. Incropera and David P. Dewitt, John Wiley and son's.
4. **Heat transfer,** P.K. Nag, Tata McGraw Hill 2002.

FINITE ELEMENT METHODS

Sub Code	**: 10ME 64**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART-A

UNIT-1

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, and stress-strain relations for plane stress and plane strains. General description of Finite Element Method, Application and limitations. Types of elements based on geometry. Node numbering, Half band width.

07 Hrs

UNIT-2

Basic Procedure: Euler - Lagrauge equation for bar, beam (cantilever / simply supported fixed) Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method. Direct approach for stiffness matrix formulation of bar element. Galerkin's method.

07 Hrs

UNIT-3

Interpolation Models: Interpolation polynomials- Linear, quadratic and cubic. Simplex complex and multiplex elements. 2D PASCAL's triangle. CST elements-Shape functions and Nodal load vector, Strain displacement matrix and Jacobian for triangular and rectangular element.

07 Hrs

UNIT-4

Solution of 1-D Bars: Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Guass-elimination technique.

06 Hrs

PART-B

UNIT-5

Higher Order Elements: Langrange's interpolation, Higher order one dimensional elements-Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Iso-parametric, Sub parametric and Super parametric elements. numerical integration : 1, 2 and 3 gauge point for 1D and 2D cases.

06 Hrs

UNIT-6

Trusses: Stiffness matrix of Truss element. Numerical problems.

06 Hrs

UNIT-7

Beams: Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads. **06 Hrs**

UNIT-8

Heat Transfer: Steady state heat transfer, 1D heat conduction governing equations. Functional approach for heat conduction. Galerkin's approach for heat conduction. 1D heat transfer in thin fins.

07 Hrs

TEXT BOOKS:

1. **Finite Elements in Engineering**, T.R.Chandrupatla, A.D Belegunde, 3rd Ed PHI.
2. **Finite Element Method in Engineering**, S.S. Rao, 4th Edition, Elsevier, 2006.

REFERENCE BOOKS:

1. **"Finite Element Methods for Engineers"** U.S. Dixit, Cengage Learning, 2009
2. **Concepts and applications of Finite Element Analysis**, R.D. Cook D.S Maltus, M.E Plesha, R.J.Witt, Wiley 4th Ed, 2009
3. **Finite Element Methods**, Daryl. L. Logon, Thomson Learning 3rd edition, 2001.
4. **Finite Element Method**, J.N.Reddy, McGraw -Hill International Edition.

MECHATRONICS & MICROPROCESSOR

Sub Code	**: 10ME 65**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction to Mechatronic Systems: Measurement and control systems Their elements and functions, Microprocessor based controllers.

06 Hours

UNIT - 2

Review of Transducers and Sensors: Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors.

07 Hours

UNIT 3

Electrical Actuation Systems: Electrical systems, Mechanical switches, solid-state switches, solenoids, DC & AC motors, Stepper motors and their merits and demerits.

06 Hours

UNIT - 4

Signal Conditioning: Introduction to signal conditioning. The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals Multiplexers, Data acquisition, Introduction to Digital system. Processing Pulse-modulation.

07 Hours

PART - B

UNIT - 5

Introduction to Microprocessors: Evolution of Microprocessor, Organization of Microprocessors (Preliminary concepts), basic concepts of programming of microprocessors.

Review of concepts - Boolean algebra, Logic Gates and Gate Networks, Binary & Decimal number systems, memory representation of positive and negative integers, maximum and minimum integers. Conversion of real, numbers, floating point notation, representation of floating point numbers, accuracy and range in floating point representation, overflow and underflow, addition of floating point numbers, character representation.

07 Hours

UNIT - 6

Logic Function: Data word representation. Basic elements of control systems 808SA processor architecture terminology such as CPU, memory and address, ALU, assembler data registers, Fetch cycle, write cycle, state, bus, interrupts. Micro Controllers. Difference between microprocessor and micro controllers. Requirements for control and their implementation in microcontrollers. Classification of micro controllers.

07 Hours

UNIT - 7

Organization & Programming of Microprocessors: Introduction to organization of INTEL 808S-Data and Address buses, Instruction set of 8085, programming the 8085, assembly language programming.

06 Hours

UNIT - 8

Central Processing Unit of Microprocessors: Introduction, timing and control unit basic concepts, Instruction and data flow, system timing, examples of INTEL 8085 and INTEL 4004 register organization.

06 Hours

TEXT BOOKS:

1. **Mechatronics,** W.Bolton, Longman, 2Ed, Pearson Publications, 2007.
2. **Microprocessor Architecture, Programming And Applications With 8085/8085A,** R.S. Ganokar, Wiley Eastern.

REFERENCE BOOKS:

1. **Mechatronics and Microprocessors,** K.P.Ramchandran, G.K.Vijayraghavan, M.S.Balasundran, Wiley, 1st Ed, 2009
2. **Mechatronics - Principles, Concepts and applications** – Nitaigour and Premchand Mahilik - Tata McGraw Hill- 2003.
3. **Mechatronics Principles & applications**, Godfrey C. Onwubolu, Elsevier..
4. **Introduction Mechatronics & Measurement systems**, David.G. Aliciatore & Michael. B. Bihistaned, Tata McGraw Hill, 2000.

HEAT & MASS TRANSFER LABORATORY

Sub Code	**: 10MEL 67**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 42**	**Exam Marks**	**: 50**

PART - A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
5. Determination of Heat Transfer Coefficient in a Forced Convention Flow through a Pipe.
6. Determination of Emissivity of a Surface.

21 Hours

PART - B

1. Determination of Stefan Boltzman Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers
3. Experiments on Boiling of Liquid and Condensation of Vapour

4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air - Conditioner
6. Experiment on Transient Conduction Heat Transfer

21 Hours

Scheme for Examination:

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		**50 Marks**

COMPUTER AIDED MODELING AND ANALYSIS LABORATORY

Sub Code	**: 10MEL 68**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 42**	**Exam Marks**	**: 50**

PART - A

Study of a FEA package and modeling stress analysis of

a. Bars of constant cross section area, tapered cross section area and stepped bar

6 Hours

b. Trusses – (Minimum 2 exercises)

3 Hours

c. Beams – Simply supported, cantilever, beams with UDL, beams with varying load etc (Minimum 6 exercises)

12 Hours

PART - B

a) Stress analysis of a rectangular plate with a circular hole

3 Hours

b) Thermal Analysis – 1D & 2D problem with conduction and convection boundry conditions(Minimum 4 exercises)

9 Hours

c) Dynamic Analysis
   1) Fixed – fixed beam for natural frequency determination
   2) Bar subjected to forcing function
   3) Fixed – fixed beam subjected to forcing function

9 Hours

REFERENCE BOOKS:

1. **A first course in the Finite element method,** Daryl L Logan, Thomason, Third Edition
2. **Fundaments of FEM,** Hutton – McGraw Hill, 2004
3. **Finite Element Analysis,** George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		**50 Marks**

ELECTIVE-II (GROUP - A)

THEORY OF ELASTICITY

Sub Code	**: 10ME 661**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Definition And Notation: Stress, Stress at a Point, Equilibrium Equations, Principal Stresses, Mohr's Diagram, Maximum Shear Stress, Boundary Conditions.

6 Hours

UNIT - 2

Strain At A Point: Compatibility Equations, Principal Strains, Generalised Hooke's law, Methods of Solution of Elasticity Problems – Plane Stress-Plane Strain Problems.

7 Hours

UNIT - 3

Two Dimensional Problems: Cartesian co-ordinates – Airy's stress functions – Investigation of Airy's Stress function for simple beam problems – Bending of a narrow cantilever beam of rectangular cross section under

edge load – method of Fourier analysis – pin ended beam under uniform pressure.

7 Hours

UNIT - 4

General Equations In Cylindrical Co-Ordinates: Thick cylinder under uniform internal and / or external pressure, shrink and force fit, stress concentration.

6 Hours

PART - B

UNIT - 5

Stresses In An Infinite Plate (with a circular hole) subjected to uniaxial and biaxial loads, stress concentration, stresses in rotating discs and cylinders.

7 Hours

UNIT - 6

Torsion Of Circular, Elliptical And Triangular Bars: membrane analogy, torsion of thin open sections and thin tubes.

6 Hours

UNIT - 7

Thermal Stresses: Thermo elastic stress strain relationship, Equations of equilibrium Thermal stresses in thin circular discs and in long circular cylinder, sphere.

7 Hours

UNIT - 8

Uniqueness Theorem: Principle of super position, reciprocal theorem, saint venant principle.

6 Hours

TEXT BOOKS:

1. **Advanced Mechanics of solids**, L. S. Srinath, Tata Mc. Graw Hill, 2003
2. **Theory of Elasticity,** S. P. Timoshenko and J. N Gordier, Mc.Graw Hill International, 3rd edition, 1972

REFERENCES BOOKS:

1. **Theory of Elasticity,** Dr. Sadhu Singh, Khanna Publications, 1988
2. **Elasticity, Theory, Applications & Numericals,** Martin H Sadd, Elsevier. 2005
3. **Applied Elasticity,** Seetharamu & Govindaraju, Interline Publishing
4. **Applied Elasticity,** C.T. WANG Sc. D. McGraw Hill Book Co.1953

MECHANICS OF COMPOSITE MATERIALS

Sub Code	**: 10ME 662**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction To Composite Materials: Definition, classification and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites.

Applications: Automobile, Aircrafts. missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.

06 Hours

UNIT - 2

Fiber Reinforced Plastic Processing: Lay up and curing, fabricating process, open and closed mould process, hand lay up techniques; structural laminate bag molding, production procedures for bag molding; filament winding, pultrusion, pulforming, thermo-forming, injection molding, blow molding.

07 Hours

UNIT - 3

Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli by Rule of mixture, Numerical problems. **Macro Mechanics of a Lamina:** Hooke's law for different types of materials, Number of elastic constants, Two - dimensional relationship of compliance and stiffness matrix.

07 Hours

UNIT – 4. Macro Mechanics of a Lamina Hooke's law for two-dimensional angle lamina, engineering constants - Numerical problems. Stress-Strain relations for lamina of arbitrary orientation, Numerical problems.

06 Hours

PART - B

UNIT – 5

Biaxial Strength Theories: Maximum stress theory, Maximum strain theory, Tsai-Hill theory, Tsai, Wu tensor theory, Numerical problems.

06 Hours

UNIT – 6

Macro Mechanical Analysis of Laminate: Introduction, code, Kirchoff hypothesis, CL T, A, B, and D matrices (Detailed derivation) , Special cases of laminates, Numerical problems**.**

06 Hours

UNIT - 7

Metal Matrix Composites: Reinforcement materials, types, characteristics and selection base metals selection. Need for production MMC's and its application.

Fabrication Process For Mmc's: Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques.

07 Hours

UNIT - 8

STUDY PROPERTIES OF MMC'S: Physical Mechanical, Wear, machinability and Other Properties. Effect of size, shape and distribution of particulate on properties.

07 Hours

TEXT BOOKS:

1. **Composite Science and Engineering,** K. K. Chawla Springer Verlag 1998.
2. **Mechanics of composite materials,** Autar K. Kaw CRC Press New York.

REFERENCE BOOKS:

1. **Fiber Reinforced Composites,** P. K. Mallick, Marcel Dekker,Inc
2. **Mechanics of Composite Materials**, Robert M. Jones, McGraw Hill Kogakusha Ltd.1998
3. **Composite materials hand book,** Meing Schwaitz," McGraw Hill book company.1984
4. **Principles of composite Material mechanics,** Ronald F. Gibron. McGraw Hill international, 1994.
5. **Mechanics of Composite Materials and Structures**, Madhujit Mukhopadhyay , University Press 2009

REFRIGERATION AND AIR CONDITIONING

Sub Code	**: 10ME 663**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Methods Of Refrigeration: Ice refrigeration, evaporative refrigeration, air refrigeration, vapour refrigeration, dry ice refrigeration, thermo electric refrigeration, pulse tube refrigeration, thermoacoustic refrigeration.

06 Hours

UNIT – 2

Gas Cycle Refrigeration: Introduction , reverse Carnot cycle, Bell Coleman cycle, advantages & dis-advtanges of gas refrigeration system. Applications to aircraft refrigeration, Analysis of gas refrigeration and Numericals.

06 Hours

UNIT – 3

Multi Pressure Vapour Compression Systems: Multi stage compression, Multi evaporator systems, Cascade systems, calculation, production of solid carbon dioxide, System practices for multistage system.

07 Hours

UNIT - 4

Refrigerants: Types of Refrigerants, Comparative study of Ethane and Methane derivatives, selection of Refrigerants, Requirements of Refrigerants, Effects of lubricants in Refrigerants, substitutes of CFC Refrigerants, Mixture Refrigerants-azeotropic mixtures

07 Hours

PART - B

UNIT – 5

Equipments Used In Vapour Compression Refrigeration System: Compressors: Principle, types of compressors, capacity control. Condensers: Types and construction, Expansion devices: Types- Automatic expansion valve, Thermostatic expansion valves, capillary tube. Sizing Evaporator: Types & construction.

06 Hours

UNIT - 6

Vapour Absorption System: Common refrigerant absorbent combinations, Binary mixtures, Ammonia Water Absorption system, Actual vapour absorption cycle and its representation on enthalpy. composition diagram, calculations. Triple fluid vapour absorption refrigeration system. Water - Lithium Bromide absorption chiller.

07 Hours

UNIT - 7

Design Conditions: Outside design conditions, choice of inside conditions, comfort chart. Choice of supply design condition.

Load Calculations And Applied Psychometrics: Internal heat gains, system heat gains, break up of ventilation load and effective sensible heat factor, Bypass factor, cooling load estimate. Psychometric calculations for cooling. Selection of Air conditioning apparatus for cooling and dehumidification, evaporative cooling.

07 Hours

UNIT - 8

Transmission And Distribution Of Air: Room Air Distribution, Friction loss in ducts, dynamic losses in ducts, Air flow through simple Duct system, Duct design.

Controls In Refrigeration And Air Conditioning Equipments: High pressure and low pressure cut out, thermostats, pilot operated solenoid valve, motor controls, bypass control-Damper motor. VAV controls.

06 Hours

TEXT BOOKS:

1. '**Refrigeration and Air-Conditioning'** C. P. Arora, Tata McGraw Hill Publication, 2nd edition, 2001.
2. '**Refrigeration and Air-Conditioning'** W. F. Stoecker, Tata McGraw Hill Publication, 2nd edition, 1982.
3. **ASHRAE,** Hand Book, 2009

REFERENCE BOOKS:

1. '**Principles of Refrigeration'** Dossat, Pearson-2006.
2. **'Heating, Ventilation and Air Conditioning',** McQuistion, Wiley Students edition, 5th edition 2000.
3. **'Air conditioning'** PITA, 4th edition, pearson-2005
4. '**Refrigeration and Air-Conditioning'** Manohar prasad
5. '**Refrigeration and Air-Conditioning'** S C Arora & S Domkundwar, Dhanpat Rai Publication

DESIGN OF HEAT EXCHANGER

Sub Code	**: 10ME 664**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction To Heat Exchanger Design: Types of heat exchangers and their applications. Flow arrangements and temperature distributions in transfer type of heat exchangers. Overall heat transfer coefficient;- Clean overall heat transfer coefficient, dirt factor dirt overall heat transfer coefficient, dirt factors for various process services. Basic design equation. Mean temperature difference Concept: - LMTD for parallel flow and counter flow arrangement, correction factor for LMTD for cross flow and multi – pass heat exchangers.

06 Hours

UNIT - 2

Shell And Tube Heat Exchangers: Constructional features. Applications. Effectiveness-NTU method for heat exchanger design/ analysis. Rating and sizing problem. Correlations for tube side pressure drop and heat transfer coefficients. Pressure drop and heat transfer coefficient correlations for shell side flow.

06 Hours

UNIT - 3

Effect Of By – Pass And Leakage Calculation Procedure For Shell And Tube Heat Exchanger: Heat balance equations: LMTD: reference temperature calculations: evaluation of fluid properties: flow assignments: tube side flow area calculations; viscosity correction factor, shell side equivalent diameter, calculation of shell side heat transfer coefficient, evaluation for wall temperature, evaluation of overall heat transfer coefficient, Calculation of surface area. Calculations of tube side and shell side pressure drops.

08 Hours

UNIT - 4

Steam Condensers: Specifications of other details as per TEMA standards. Flow arrangement for increased heat recovery: - lack of heat recovery in 1-2 exchangers true temperature difference in a 2-4 exchanger. Calculation procedure for steam condensers.

06 Hours

PART - B

UNIT - 5

Double Pipe Heat Exchangers: Constructional features. Applications. Design parameters :- tube side and shell side film coefficients cut and twist

factor, fin efficiency, overall heat transfer coefficient, mean temperature difference, available surface area, fin geometry fin height, number of fins, tube side and shell side pressure drop. Calculation procedure for the design/ analysis of double pipe heat exchanger.

06 Hours

UNIT - 6

Compact Heat Exchangers: Introduction; definition of Geometric Terms: plate fin surface geometries and surface performance data; correlation of heat transfer and friction data; Goodness factor comparisons; specification of rating and sizing problems; calculation procedure for a rating problem.

06 Hours

UNIT - 7

Air-Cooled Heat Exchangers: Air as coolant for industrial processes; custom-built units; fin-tube systems for air coolers; fin-tube bundles; thermal rating; tube side flow arrangements; cooling air supply by fans; cooling air supply in natural draft towers.

06 Hours

UNIT - 8

Furnaces And Combustion Chambers: Introduction; process heaters and boiler; heat transfer in furnaces: - Heat source; Heat sink; refractory surfaces; heat transfer to the sink; Design methods: - Method of Lobo and Evans: Method of Wilson, Lobo and Hottel; The Orrok-Hudson equation; Wallenberg simplified method.

08 Hours

TEXT BOOKS:

1. **Process Heat Transfer**: Donald Q. Kern, Tata McGraw –Hill Edition (1997)
2. **Compact Heat Exchangers:** W. M. Kays & A. L. London, Mcgraw –Hill co. (1997)

REFERENCE BOOKS:

1. **Heat Transfer – A Basic Approach:** Necati Ozsisik, McGraw – Hill International edition (1985).
2. **Heat Exchanger Design Hand Book:** Volumes 2 and 3, edited by Ernst U schlunder. et. al Hemisphere Publishing Co. (1983)
3. **Heat exchanger-** Kokac Thermal- hydraulic and design analysis.

NON-TRADITIONAL MACHINING

Sub Code	**: 10ME 665**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: History, Classification, comparison between conventional and Non-conventional machining process selection.

05 Hours

UNIT - 2

Ultrasonic Machining (Usm): Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design:- Effect of parameter: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM.

08 Hours

UNIT - 3

Abrasive Jet Machining (Ajm): Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. abrasive particles per unit volume of the carrier gas, work material, stand off distance (SOD), nozzle design, shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining**:** Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery

07 Hours

UNIT - 4

Electrochemical Machining (Ecm): Introduction, study of ECM machine, elements of ECM process : Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations.

06 Hours

PART - B

UNIT - 5

Chemical Machining (Chm): Introduction, elements of process, chemical blanking process : Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps –masking, Etching, process characteristics of CHM: material removal rate, accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM.

06 Hours

UNIT - 6

Electrical Discharge Machining (Edm): Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design, choice of machining operation, electrode material selection, under sizing and length of electrode, machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, Heat Affected Zone. Machine tool selection, Application, EDM accessories / applications, electrical discharge grinding, Traveling wire EDM.

08 Hours

UNIT - 7

Plasma Arc Machining (Pam): Introduction, equipment, non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, Applications, Advantages and limitations.

05 Hours

UNIT - 8

Laser Beam Machining (Lbm): Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations.

Electron Beam Machining (Ebm): Principles, equipment, operations, applications, advantages and limitation of EBM.

07 Hours

TEXT BOOKS:

1. **Modern machining process,** Pandey and Shan, Tata McGraw Hill 2000
2. **New Technology,** Bhattacharya 2000

REFERENCE BOOKS:

1. **Production Technology,** HMT Tata McGraw Hill. 2001

2. **Modern Machining Process,** Aditya. 2002

3. **Non-Conventional Machining,** P.K.Mishra, The Institution of Engineers (India) Test book series, Narosa Publishing House – 2005.

4. **Metals Handbook: Machining Volume 16,** Joseph R. Davis (Editor), American Society of Metals (ASM)

KNOWLEDGE MANAGEMENT

Sub Code	**: 10ME 666**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Knowledge Influences : Introduction, External influences on organizations, Changing nature of management, Types of organizations, Strategic management in organizations, Knowledge management, Knowledge management an emerging concept, Model of strategic knowledge management.

07 Hours

UNIT 2

Introduction to Key Concepts : What is Management? Knowledge Management and business strategies, Knowledge intensive firms and Knowledge workers, Learning and Knowledge Management

06 Hours

UNIT 3

Knowledge Creation and Loss : Innovation dynamics and knowledge processes, characterizing innovation processes, innovation as an interactive process, knowledge creation and Nonaka, the social dynamics of innovation networking processes, forgetting and unlearning knowledge

07 Hours

UNIT 4

Developing and Managing Knowledge Repositories : Effective knowledge repositories, mapping the content structure, repository quality control, case studies (not for examination)

06 Hours

PART B

UNIT 5

Design Knowledge Management System : Introduction, Structure-preserving design, Step 1: design system architecture, Step 2: identify target implementation platform, Step 3: specify architectural components, Step 4: specify application within architecture, design of prototypes, distributed architecture.

07 Hours

UNIT 6

Socio-Cultural Issues : Introduction, significance of cross community knowledge processes, characterizing cross community knowledge processes, identity, knowledge, trust and social relations, classification of boundary types, facilitating/managing knowledge between communities

06 Hours

UNIT 7

Knowledge Leadership : Introduction, contributions of disciplines to Knowledge Leadership, the generic attributes of knowledge leader, specific knowledge leadership roles, leading knowledge teams, leading a knowledge network, recruiting and selecting knowledge leaders

06 Hours

UNIT 8

Information and Communication Technologies and Knowledge Management : Introduction, linking knowledge management and ICTs, objectivist perspectives on ICT – enabled knowledge management, practice based perspectives on ICT enabled KM, the importance of accounting for socio cultural factors in ICT enabled KM, debates regarding the role of ICTs in KM processes.

07 Hours

TEXT BOOKS:

1. **Knowledge Management,** Shelda Debowski, Wiley India, 2007.
2. **Knowledge Management in Organizations,** Donald Hislop**,** 2nd Ed., Oxford University Press, 2009

REFERENCE BOOKS:

1. **Knowledge Engineering and Management,** Guus Schreiber, et al, University Press India Pvt. Ltd., 2003
2. **Knowledge Management - Classic and contemporary works,**Daryl Morey, et. al., 2007

PROJECT MANAGEMENT

Sub Code	**: 10ME 667**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT 1

Introduction: Definition of project, characteristics of projects, understand projects, types of projects, scalability of project tools, project roles,

04 Hours

UNIT 2

Project Selection And Prioritization – Strategic planning process, Strategic analysis, strategic objectives, portfolio alignment – identifying potential projects, methods of selecting projects, financial mode / scoring models to select projects, prioritizing projects, securing and negotiating projects.

05 Hours

UNIT 3

Planning Projects: Introduction, developing the project management plan, understanding stake holders, communication planning, project meeting management, communication needs of global and virtual project teams, communication technologies, Constructing Work Breakdown Structures – scope planning, scope definition, work breakdown structures (WBS), Using Microsoft project for work breakdown structures.

08 Hours

UNIT 4

Scheduling Projects: purpose of a project schedule, historical development, how project schedules are limited and created, develop project schedules, uncertainty in project schedules, Gantt Chart, Using Microsoft Project for critical path schedules.

08 Hours

PART - B

UNIT 5

Resourcing Projects: Abilities needed when resourcing projects, estimate resource needs, creating staffing management plant, project ream composition issues, assign resource to each activity, resource overloads, critical chain project management (CCPM), compress the project schedule, Using Microsoft Project for resource allocation.

Budgeting Projects: Cost planning, cost estimating, cost budgeting, establishing cost control, using Microsoft Project for Project Budgets,

08 hours

UNIT 6

Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning, Project Quality Planning and Project Kickoff: Development of quality concepts, project quality management plan, project quality tools, kickoff project, baseline and communicate project management plan, using Microsoft Project for project baselines.

06 Hours

UNIT 7

Performing Projects: Project supply chain management: - Plan purchasing and acquisitions, plan contracting, contact types, project partnering and collaborations, project supply chain management, Leading and Managing Project Teams – Acquiring, developing, managing and leading the project team, managing stakeholders, managing project conflicts.

07 Hours

UNIT 8

Determining Project Progress and Results: Project Balanced Scorecard Approach, Internal project, customer, financial issues, Using Microsoft Project to monitor and control projects. Finishing the project: Terminate project early, finish projects on time, secure customer feedback and approval, knowledge management, perform administrative and contract closure, celebrate success and reward participant, provide ongoing support.

06 Hours

TEXT BOOK:

1. **Project Management**, Timothy J Kloppenborg, Cengage Learning, Edition 2009.
2. **Project Management**, A systems approach to planning schuduing and controlling by Harold kerzner, CBS publication.

REFERENCE:

1. **Project Management Refer,** Pennington Lawrence, Mc Graw hill
2. **Project Management,** A Moder Joseph and Phillips New Yark Van Nostrand, Reinhold.
3. **Project Management,** Bhavesh M. Patal, Vikas publishing House,

STATISTICAL QUALITY CONTROL

Sub Code	**: 10ME 668**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: The Meaning of Quality and Quality Improvement; Brief History of Quality Methodology; Statistical Methods for Quality Control and Improvement; Total Quality Management (quality philosophy, links between quality and productivity, quality costs, legal aspects of quality implementing, quality improvement).

06 Hours

UNIT - 2

Modeling Process Quality: Mean, Median, Mode, Standard deviation, Calculating area, The Deming funnel experiment, Normal distribution tables, Finding the Z score, Central limit theorem.

06 Hours

UNIT - 3

Methods And Philosophy Of Statistical Process Control: Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, Average Run Length-ARL)

06 Hours

UNIT - 4

Control Charts For Variables: Control Charts for X-Bar and R- Charts, Type I and Type II errors, the probability of Type II error. Simple Numerical Problems

08 Hours

PART - B

UNIT - 5

Process Capability: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk}, p_p – process performance index, summary of process measures. Numerical problems

06 Hours

UNIT 6: Control Charts For Attributes: Binomial distribution, Poisson distribution (from the point of view of Quality control) Control Chart for Fraction Nonconforming, Control Chart for number Nonconforming, Control Charts for Nonconformities or Defects, Control Chart for Number of non conformities per unit. Numerical problems

07 Hours

UNIT - 7

Lot-By-Lot Acceptance Sampling For Attributes: The acceptance sampling problem, single sampling plan for attributes, Double, Multiple, and Sequential sampling, AOQL, LTPD, OC curves, Military Standard 105E, the Dodge-Romig sampling plans. Numerical problems

07 Hours

UNIT - 8

Cumulative-Sum (Cusum) & Exponentially Weighted Moving Average (Ewma) Control Charts: CUSUM Control Chart (basic principles of the chart for monitoring the process mean); EWMA control chart (EWMA control chart for monitoring process mean), design of an EWMA control chart.

06 Hours

TEXT BOOKS:

1. **Statistical Quality Control,** E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher.
2. **Statistical Quality Control,** RC Gupta, Khanna Publishers, New Delhi, 2005

REFERENCE BOOKS:

1. **Statistical Process Control and Quality Improvement,** Gerald M. Smith, Pearson Prentice Hall. ISBN 0 – 13-049036-9.
2. **Statistical Quality Control for Manufacturing Managers,** W S Messina, Wiley & Sons, Inc. New York, 1987
3. **Statistical Quality Control,** Montgomery, Douglas, 5^{th} Edition, John Wiley & Sons, Inc. 2005, Hoboken, NJ (ISBN 0-471-65631-3).
4. **Principles of Quality Control,** Jerry Banks, Wiley & Sons, Inc. New York.

ENGINEERING ECONOMY

Sub Code	**: 10ME 71**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: Engineering Decision-Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Engineering Economic Decision, Maze. Law of demand and supply, Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment, Exercises and Discussion.

08 Hours

UNIT - 2

Present-Worth Comparisons: Conditions for present worth comparisons, Basic Present worth comparisons, Present-worth equivalence, Net Present-worth, Assets with unequal lives, infinite lives, Future-worth comparison, Pay-back comparison, Exercises, Discussions and problems.

06 Hours

UNIT - 3

Equivalent Annual-Worth Comparisons: Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises, Problems.

06 Hours

UNIT - 4

Rate-Of-Return Calculations And Depreciation: Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts. Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, corporate income tax.

06 Hours

PART - B

UNIT - 5

Estimating and Costing: Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal cost, Selling price, Estimation for simple components.

05 Hours

UNIT - 6

Introduction, Scope Of Finance, Finance Functions: Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account. Simple Numericals

08 Hours

UNIT - 7

Financial Ratio Analysis: Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm's earning power. Comparative statements analysis. Simple numericals

06 Hours

UNIT - 8

Financial And Profit Planning: Introduction, Financial planning, Profit planning, Objectives of profit planning, Essentials of profit planning, Budget administration, type of budgets, preparation of budgets, advantages, problems and dangers of budgeting. Introduction to Bench Marking of Manufacturing Operation.

07 Hours

TEXT BOOKS:

1. **Engineering Economy,** Riggs J.L., 4TH ed. , McGraw Hill, 2002
2. **Engineering Economy,** Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. **Engineering Economy,** Tarachand, 2000.
2. **Industrial Engineering and Management**, OP Khanna, Dhanpat Rai & Sons. 2000
3. **Financial Mangement,** Prasanna Chandra, 7th Ed., TMH, 2004
4. **Finacial Management,** IM PANDEY, Vikas Pub. House, 2002

MECHANICAL VIBRATIONS

Sub Code	**: 10ME 72**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART- A

UNIT - 1

Introduction: Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

06 Hours

UNIT -2

Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

07 Hours

UNIT - 3

Damped free vibrations (1DOF): Types of damping**,** Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

06 Hours

UNIT - 4

Forced Vibrations (1DOF): Introduction**,** Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

07 Hours

PART – B

UNIT – 5

Vibration Measuring Instruments and Whirling of shafts: Seismic Instruments – Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

06 Hours

UNIT – 6

Systems with two degrees of Freedom: Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring mass systems, masses on tightly stretched strings, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems and Problems. Undamped dynamic vibration absorber and Problems.

06 Hours

UNIT - 7

Numerical Methods for multi degree freedom of systems: Introduction, Maxwell's reciprocal theorem, Influence coefficients, Rayleigh's method, Dunkerley's method, Stodola method, Holzer's method, Orthogonality of principal modes, method of matrix iteration and Problems.

09 Hours

UNIT – 8

Modal analysis and Condition Monitoring: Signal analysis, dynamic testing of machines and structures, Experimental modal analysis, Machine condition monitoring and diagnosis**.**

05 Hours

TEXT BOOKS:

1. **Mechanical Vibrations,** S. S. Rao, Pearson Education Inc, 4th edition, 2003.
2. **Mechanical Vibrations,** V. P. Singh, Dhanpat Rai & Company, 3rd edition, 2006.

REFERENCE BOOKS:

1. **Theory of Vibration with Applications,** W. T. Thomson, M. D. Dahleh and C. Padmanabhan, Pearson Education Inc, 5th edition, 2008.
2. **Mechanical Vibrations:** S. Graham Kelly, Schaum's outline Series, Tata McGraw Hill, Special Indian Edition, 2007.
3. **Theory and Practice of Mechanical Vibrations:** J. S. Rao & K. Gupta, New Age International Publications, New Delhi, 2001.
4. **Mechanical Vibrations,** G. K.Grover, Nem Chand and Bros, 6th edition, 1996.

HYDRAULICS AND PNEUMATICS

Sub Code	**: 10ME 73**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT -1

Introduction to Hydraulic Power: Definition of hydraulic system, advantages, limitations, applications, Pascal's law, structure of hydraulic control system, problems on Pascal's law.

The source of Hydraulic Power: Pumps Classification pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump Selection factors, problems on pumps.

07 Hours

UNIT -2

Hydraulic Actuators and Motors: Classification cylinder and hydraulic motors, Linear Hydraulic Actuators [cylinders], single and double acting cylinder, Mechanics of Hydraulic Cylinder Loading, mounting arrangements, cushioning, special types of cylinders, problems on cylinders, construction and working of rotary actuators such as gear, vane, piston motors, Hydraulic Motor Theoretical Torque, Power and Flow Rate, Hydraulic Motor Performance, problems, symbolic representation of hydraulic actuators (cylinders and motors).

06 Hours

UNIT - 3

Control Components in Hydraulic Systems: Classification of control valves, Directional Control Valves- Symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, check valves, Pressure control valves - types, direct operated types and pilot operated types. Flow Control Valves - compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

07 Hours

UNIT - 4

Hydraulic Circuit Design And Analysis: Control of Single and Double - Acting Hydraulic Cylinder, Regenerative circuit, Pump Unloading Circuit, Double Pump Hydraulic System, Counter balance Valve Application, Hydraulic Cylinder Sequencing Circuits, Automatic cylinder reciprocating system, Locked Cylinder using Pilot check Valve, Cylinder synchronizing circuit using different methods, factors affecting synchronization, Hydraulic circuit for force multiplication, Speed Control of Hydraulic Cylinder, Speed Control of Hydraulic Motors, Safety circuit, Accumulators, types, construction and applications with circuits.

06 Hours

PART – B

UNIT - 5

Maintenance of Hydraulic System: Hydraulic Oils - Desirable properties, general type of Fluids, Sealing Devices, Reservoir System, Filters and Strainers, wear of Moving Parts due to solid -particle Contamination, temperature control (heat exchangers), Pressure switches, trouble shooting.

06 Hours

UNIT - 6

Introduction to Pneumatic Control: Definition of pneumatic system, advantages, limitations, applications, Choice of working medium. Characteristic of compressed air. Structure of Pneumatic control System, fluid conditioners and FRL unit.

Pneumatic Actuators: Linear cylinder - Types, Conventional type of cylinder- working, End position cushioning, seals, mounting arrangements- Applications. Rod - Less cylinders types, working, advantages, Rotary cylinders- types construction and application, symbols.

07 Hours

UNIT-7

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols. 3Hrs Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and Exhaust air throttling and Exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical Examples involving the use of logic gates, Pressure dependant controls- types - construction - practical applications, Time dependent controls principle. Construction, practical applications.

07 Hours

UNIT-8

Multi- Cylinder Application: Coordinated and sequential motion control, Motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).
Electro- Pneumatic Control: Principles - signal input and out put, pilot assisted solenoid control of directional control valves, Use of relay and contactors. Control circuitry for simple signal cylinder application.
Compressed Air: Production of compressed air- Compressors Preparation of compressed air-Driers, Filters, Regulators, Lubricators, Distribution of compressed air Piping layout.

06 Hours

TEXT BOOKS:

1. **"Fluid Power with Applications",** Anthony Esposito**,** Sixth edition, Pearson Education, Inc, 2000.
2. **'Pneumatics and Hydraulics',** Andrew Parr, Jaico Publishing Co

REFERENCE BOOKS:

1. **'Oil Hydraulic systems', Principles and Maintenance** S. R. Majurr, Tata McGraw Hill Publishing Company Ltd. - 2001
2. **'Industrial Hydraulics', Pippenger, Hicks"** McGraw Hill, New York
3. **'Hydraulic & Pneumatic Power for Production'**, Harry L. Stewart
4. **'Pneumatic Systems',** S. R. Majumdar, Tata McGraw Hill Publish 1995
5. **Power Hydraulics'** Michael J Pinches & John G Ashby, Prentice Hall

OPERATION RESEARCH

Sub Code	**: 10ME 74**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART- A

UNIT -1

Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method.

04 Hours

UNIT -2

Solution Of Linear Programming Problems: The simplex method-canonical and standard form of an LP problem, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.

08 Hours

UNIT -3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Assignment Problem-formulation, types, application to maximization cases and travelling salesman problem.

08 Hours

UNIT -4

Integer Programming: Pure and mixed integer programming problems, solution of Integer programming problems-Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-One programming.

06 Hours

PART- B

UNIT -5

Pert-CPM Techniques: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

08 Hours

UNIT -6

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models and their steady state performance analysis.

06 Hours

UNIT -7

Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

06 Hours

UNIT -8

Sequencing: Basic assumptions, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing 2 jobs on 'm' machines using graphical method.

06 Hours

TEXT BOOKS

1. **Operations Research,** P K Gupta and D S Hira, Chand Publications, New Delhi - 2007
2. **Operations Research,** Taha H A, Pearson Education

REFERNCE BOOKS

1. **Operations Research,** A P Verma, S K Kataria &Sons, 2008
2. **Operations Research,** Paneerselvan, PHI
3. **Operations Research,** A M Natarajan, P Balasubramani, Pearson Education, 2005
4. **Introduction to Operations Research,** Hillier and Liberman,8th Ed., McGraw Hill
5. **Operations Research** S.D. Sharma, Ledarnath Ramanath & Co, 2002

DESIGN LABORATORY

Sub Code	**: 10MEL 77**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 42**	**Exam Marks**	**: 50**

PART - A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Balancing of rotating masses.
3. Determination of critical speed of a rotating shaft.
4. Determination of Fringe constant of Photoelastic material using.
    a) Circular disc subjected to diametral compression.
    b) Pure bending specimen (four point bending)
5. Determination of stress concentration using Photoelasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression, 2D Crane hook.

PART - B

6. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Prowel /Hartnel Governor. (only one or more)
7. Determination of Pressure distribution in Journal bearing.
8. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
9. Determination of stresses in Curved beam using strain gauge.
10. Experiments on Gyroscope (Demonstration only)

Scheme of Examination:

One question from Part A	-	20 Marks (05 Write up +15)
One question from Part B	-	20 Marks (05 Write up +15)
Viva - Voce	-	10 Marks

Total:		**50 Marks**

CIM & AUTOMATION LAB

Sub Code	**: 10MEL 78**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 42**	**Exam Marks**	**: 50**

PART - A

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like Master- CAM, or any equivalent software.

PART - B

(Only for Demo/Viva voce)

1. FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.
2. Robot programming: Using Teach Pendent & Offline programming to perform pick and place, stacking of objects, 2 programs.

PART - C

(Only for Demo/Viva voce)

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Scheme of Examination:

Two questions from Part A	- 40 Marks (20 Write up +20)
Viva - Voce	- 10 Marks

Total:	**50 Marks**

ELECTIVE-II (GROUP B)

MECHANISM DESIGN

Sub Code	**: 10ME 751**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT-1

Planar Mechanisms and Geometry of Motion: Definitions and basic concepts, Classification of links, Classification of pairs, Mechanism and machine, Inversions, Grashof's law, Transmission of torque and force in mechanisms, Mobility, Degree of freedom permitted by joints other than turning and sliding, Equivalent mechanisms, Unique mechanisms.

07 Hours

UNIT-2

Number Synthesis: Effect of even or odd number of links on degree of freedom, Minimum number of binary links in a mechanism, Minimum possible number of turning pairs, Enumeration of kinematic chain, Degree of freedom of special mechanisms.

06 Hours

UNIT-3

Synthesis of Linkages: Type, Number and dimensional synthesis, Function generation, Path generation and body guidance, Precision positions, Structural error, Chebychev spacing, Two position synthesis of slider crank mechanisms, Crank-rocker mechanisms with optimum transmission angle.

07 Hours

UNIT-4

Motion Generation: Poles and relative poles, Relative poles of 4-bar mechanism, Relative poles of slider crank mechanism.

06 Hours

PART - B

UNIT-5

Graphical Methods of Dimensional Synthesis: Two position synthesis of crank and rocker mechanisms, Three position synthesis, Four position synthesis (point position reduction), Overlay method.

06 Hours

UNIT-6

Coupler Curves: Equation of coupler curves, Synthesis for path generation, Graphical synthesis for path generation, Robert-Chebyshev theorem (cognate linkages), Coupler curves from 5-bar mechanisms, Examples.

07 Hours

UNIT-7

Analytical Methods of Dimensional Synthesis: Freudenstein's equation for 4-bar mechanism and slider crank mechanism, Examples, Bloch's method of synthesis.

06 Hours

UNIT-8

Cams: Introduction, Pressure angle, Parameters affecting pressure angle, Effect of offset follower motion, Radius of curvature and undercutting, Cams with specified contours.

07 Hours

TEXT BOOKS:

1. **"Theory of Machines & Mechanisms",** J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed.
2. '**Mechanism & Machine Theory**', A.G. Ambekar, PHI, 2007

REFERENCE BOOKS:

1. '**Kinematics, Dynamics & Design of Machinery**', K. J. Waldron, G. L. Kinzel, Wiley India, 2007.
2. **'Advanced Mechanism Design'**, Erdman Sandoor, Vol-l PHI, 2006,
3. **"Kinematics & Dynamics of Machinery**" H.H. Mabie, F.W. Ocvirk, John Wiley & Sons, New York, 3rd Ed.

THEORY OF PLASTICITY

Sub Code	**: 10ME 752**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Fundamental Of Elasticity: Concept of stress, stress transformation laws, spherical and deviator stress tensors, equilibrium equations, octahedral stresses, concept of strain, deviator and spherical strain tensors, strain transformation laws, octahedral strains, generalized Hooke's law, elastic strain energy, compatibility equations, theories of strength. problems.

07 Hours

UNIT - 2

Plastic Deformation Of Metals: Crystalline structure in metals, mechanism of plastic deformation, factors affecting plastic deformation, strain hardening, recovery, recrystallization and grain growth, flow figures or luder's cubes.

06 Hours

UNIT - 3

Cubical Dilation, True Stress And Strain: Strain tensor, principal strain, plane strain, spherical and deviator strain, octahedral strain and representative strain, problems.

07 Hours

UNIT - 4

Stress Strain Relations: Introduction, types of materials, empirical equations, theories of plastic flow, experimental verification of St.Venant's theory of plastic flow, the concept of plastic potential, the maximum work hypothesis, mechanical work for deforming a plastic substance.

06 Hours

PART - B

UNIT - 5

Yield Criteria: Introduction, yield or plasticity conditions, Von Mises and Tresca criteria, Geometrical representation, yield surface, yield locus (two dimensional stress space), experimental evidence for yield criteria, energy required to change the shape with basic principle problems

07 Hours

UNIT - 6

Slip Line Field Theory: Introduction, basic equations for incompressible two dimensional flow, continuity equations, stresses in conditions of plain strain, convention for slip lines, solutions of plastic deformation problem, Geometry of slip line field, Properties of the slip lines, construction of slip line nets

07 Hours

UNIT - 7

Bending Of Beams: Analysis for stresses, Non linear stress strain curve, shear stress distribution, residual stresses in plastic bending, problems.

06 Hours

UNIT - 8

Torsion Of Bars: Introduction, plastic torsion of a circular bar, elastic perfectly plastic material, elastic work hardening of material, residual stresses and problems

06 Hours

TEXT BOOKS:

1. '**Theory of Plasticity',** Chakraborty 3rd Edition Elsevier.
2. **'Engineering Plasticity',** W. Johnson and P. B. Mellor D Van N.O Strand Co. Ltd 2000

REFERENCE BOOKS:

1. **Basic Engineering Plasticity,** DWA Rees 1st Edition Elsevier.
2. **Theory of Plasticity,** L. S. Srinath TMH,
3. **Theory of Plasticity,** Sadhu Singh, Kanna publisher

ENGINEERING DESIGN

Sub Code	**: 10ME 753**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

UNIT-A

UNIT-1

Identifying Customer Needs, Gather raw data from customers, Interpret raw data in terms of customer needs, Organize the needs into a hierarchy, Establish the relative importance of the needs, Reflect on the results and the process.

06 Hrs

UNIT -2

The Design Process: Introduction, The design process, The design process steps, A detailed morphology of design, Further considerations in design, Spectrum of engineering activities, Organization of the engineering function, The product life cycle, Technological forecasting and innovation, Market identification, Competitive benchmarking ,Human factors in design

07 Hrs

UNIT-3

Design Methods: Introduction, Creativity and problem solving, Creativity methods, The problem statement, Product design specifications, Concept selection technique, Methods of conceptual design, Design principles, Decision theory, Evaluating alternatives, Decision trees.

07 Hrs

UNIT-4

Modeling and Simulation: Role of models in design, Mathematical modeling, Similitude and scale models, Simulation, Geometric modeling.

06 Hrs

UNIT-B

UNIT-5

Human Engineering Consideration: Introduction, Human being as applicator of forces, Anthropometry, The design of controls, Design of displays, Man/Machine information exchange.

07 Hrs

UNIT-6

Risk and Reliability: Probabilistic approach to design, Reliability theory, Design for reliability, Hazard analysis, Bath tub curve, Mean life, MTTF and MTBF, Exponential and Weibull distribution, series and parallel configuration, Combination of series and parallel configuration Fault tree analysis.

07 Hrs

UNIT-7

Material Selection: Performance characteristics of materials, Material selection process, Sources of information on materials, Economics of materials, Methods of material selection, cost verses performance relations, weighted property index, Value analysis.

06 Hrs

UNIT-8

Robust Design: What is robust design, Identify control factors, Noise factors, Formulate an objective function, Develop the experimental plan, Run the experimental plan, Conduct the analysis, Select and confirm factor set points, Reflect and repeat.

06 Hrs

TEXT BOOKS:

1. **Engineering Design** *: A Materials and Processing Approach*, George E. Dieter, 4th Ed., Mc. Graw Hill Company, Newyork
2. **Product Design and Development**. T. Ulrich. and S. D. Eppinger, Tata Mc Graw Hill -2003

REFERENCE BOOKS:

1. **The Mechanical Design Process**, D,. G. Ullman. 4th Ed., International Edition, 1992.
2. **Product Design and Manufacturing**, A. K. Chitale, R. C. Gupta, PHI, 2nd Ed – 2002.

NON-CONVENTIONAL ENERGY RESOURCE

Sub Code	**: 10ME 754**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

Subject Code	:	**10ME754**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

Will be sent Latter

GAS DYNAMICS

Sub Code	**: 10ME 755**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Fundamental Equations Of Steady Flow: Continuity and momentum equations, The thrust function, The dynamic equation and Euler's Equation. Bernoulli's Equation. Steady flow energy equation.

08 Hours

UNIT - 2

Isentropic Flow: Acoustic velocity, Mach number, Mach cone and Mach angle. Flow parameters, stagnation temperature, pressure, and density.

06 Hours

UNIT - 3

Adiabatic Flow: Stagnation temperature change. Rayleigh line, Pressure ratio and temperature ratio, Entropy considerations, maximum heat transfer.

06 Hours

UNIT - 4

Flow With Friction: The fanning equation, Friction factor and friction parameter, Fanno line, Fanno equations.

06 Hours

PART - B

UNIT - 5

Wave Phenomena: Classification of wave phenomena, analysis of shock phenomena, Hugoniot equation. Weak waves, compression waves, Normal shock waves, oblique shock waves, Entropy considerations, Rayleigh Pilot equations, detonation and deflageration.

06 Hours

UNIT - 6

Variable Area Flow: Velocity variation with Isentropic flow, Criteria for acceleration and deceleration. Effect of pressure ratio on Nozzle operation. Convergent nozzle and convergent divergent nozzle. Effect of back pressure on nozzle flow. Isothermal flow functions. Comparison of flow in nozzle. Generalized one dimensional flow.

07 Hours

UNIT - 7

Applications of dimensional analysis and similitude to gas dynamic problems.

06 Hours

UNIT - 8

Introduction To Flames And Combustion: Flame propagation, diffusion flames, premixed flames, flame velocity, theories of flame propagation, ignition for combustible mixture, flame stabilization.

07 Hours

TEXT BOOKS:

1. **Fundamentals of Compressible flow**: Yahya, 2nd Edn. 1991; Wieley Eastern.
2. **Gas Dynamics,** E Radhakrishnan PHI-2006

REFERENCE BOOKS:

1. **Introduction to Gas Dynamics:** Rolty, Wiley 1998
2. **Elements of Gas Dynamics:** Liepmann and Roshko, Wiley 1994.
3. **The dynamics and thermodynamics of compressible fluid flow:** Shapiro Ronold press. 1994.
4. **Compressible Fluid Flow**, J. F. Anderson

MANAGEMENT INFORMATION SYSTEM

Sub Code	**: 10ME 756**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

The Information Age: An Overview: The purpose, data, information, and information systems and their types, ethical and societal issues, information systems in business functions, web empowered enterprises.

05 Hours

UNIT - 2

Strategic Uses of Information Systems: Strategies and Strategic moves, Achieving a competitive advantage, creating and maintaining strategic information systems, Business Functions and Supply Chains – effectiveness and efficiency, accounting, finance, engineering, supply chain management, Human resource management, Enterprise resource planning.

05 Hours

UNIT - 3

Information Technology: Business Hardware – components, classification of computers, output devices, storage media, and purchasing,, Business

Software – programming languages and software development tools, language translation, compilers and interpreters, system software, open source software, software licensing, ethical issues,

08 Hours

UNIT - 4

Business Networks and Telecommunication: Telecommunication in Business and Daily Use, Bandwidths and Media, networks, protocols, internet networking services, Telecommuting – pros and cons, Future of Networking Technologies.

08 Hours

PART - B

UNIT - 5

Web Enabled Commerce: Web enabled enterprises – web business and technologies, web enabled business, Challenges of Global Information Systems – Multinational organizations, international commerce, ethical issues.

07 hours

UNIT - 6

Decision Support and Business intelligence: Decision support and expert systems – decision support and decision making process, structured and unstructured problems, decision support systems, expert systems, geographical systems, Business Intelligence and Knowledge Management – Date Mining and online analysis, knowledge management,

06 Hours

UNIT - 7

Planning, Acquisition, and Control: Systems Planning and Development – Planning Information systems, systems development life cycle, agile methods, systems integration, ethical issues – IS professionals certification.

07 Hours

UNIT - 8

Choices in Systems Acquisition: Options and Priorities, outsourcing, licensing applications, software as a service, user application development, ethical issues- computer use policies for employees.

06 Hours

TEXT BOOK

1. **Management Information Systems**, Effy Oz, Cengage Learning, INDIA EDITION, 2009.
2. **Management Information Systems**, James A O'Brien, Irwin, 9th Ed., McGraw Hill.

REFERENCE BOOKS:

1. **Management Information Systems,** Laudon & Laudon, PHI 1998 Ed. ISBN 81-203-1282-1

2. **Management Information systems,** S.Sadagopan, Prentice Hall of India, 1998 Ed. ISBN 81-203-1180-9

3. **Information systems for Modern management** G.R.Murdick PHI 2002.

AUTOMATION IN MANUFACTURING

Sub Code	**: 10ME 757**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: Production System Facilities, Manufacturing Support systems, Automation in Production systems, Automation principles & Strategies

05 Hours

UNIT - 2

Manufacturing Operations: Manufacturing Operations, Product/Production Relationship, Production concepts and Mathematical Models & Costs of Manufacturing Operations

07 Hours

UNIT - 3

Industrial Control System: Basic Elements of an Automated System, Advanced Automation Functions & Levels of Automation, Continuous versus Discrete control, Computer Process control, Forms of Computer Process Control.

07 Hours

UNIT - 4

Automated Manufacturing Systems: Components of a Manufacturing systems, Classification of Manufacturing Systems, overview of Classification Scheme, Single Station Manned Workstations and Single Station Automated Cells.

07 Hours

PART - B

UNIT - 5

Group Technology & Flexible Manufacturing Systems: Part Families, Parts Classification and coding, Production Flow Analysis, Cellular Manufacturing, Flexible Manufacturing Systems: What is an FMS, FMS Components, FMS Applications & Benefits, and FMS Planning & Implementation Issues.

08 Hours

UNIT - 6

Quality Control Systems: Traditional and Modern Quality Control Methods, Taguchi Methods in Quality Engineering. Introduction to SQC Tools.

04 Hours

UNIT - 7

Inspection Technologies: Automated Inspection, Coordinate Measuring Machines Construction, operation & Programming, Software, Application & Benefits, Flexible Inspection System, Inspection Probes on Machine Tools, Machine Vision, Optical Inspection Techniques & Non-contact Non-optical Inspection Technologies

06 Hours

UNIT - 8

Manufacturing Support System: Process Planning, Computer Aided Process Planning, Concurrent Engineering & Design for Manufacturing, Advanced Manufacturing Planning, Just-in Time Production System, Basic concepts of lean and Agile manufacturing. Basic Concepts of Lean and Agile manufacturing, Comparisons of Lean & Agile Manufacturing.

08 Hours

TEXT BOOKS:

1. **Automation, Production Systems and Computer Integrated Manufacturing,** M. P. Groover, Pearson education. Third Edition, 2008
2. **Principles of CIM,** Vajpayee, PHI.

REFERENCE BOOKS:

1. **Anatomy of Automation**, Amber G.H & P. S. Amber, Prentice Hall.
2. **Performance Modeling of Automated Manufacturing Systems,** Viswanandham, PHI
3. **Computer Based Industrial Control**, Krishna Kant, EEE-PHI

TOTAL QUALITY MANAGEMENT

Sub Code	**: 10ME 758**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

06 Hours

UNIT - 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

06 Hours

UNIT - 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction **:** customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, Case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

07 Hours

UNIT - 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Tools and Techniques: Benching marking, information technology, quality management systems, environmental management system, quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

07 Hours

PART - B

UNIT - 5

Quality Management Tools : Why Why, forced filed analysis, nominal group technique, affinity diagram, interrelationship digraph, tree diagram, matrix diagram, prioritization matrices, process decision program chart, activity network diagram.

07 hours

UNIT - 6

Statistical Process Control : Pareto diagram, process flow diagram, cause-and-effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

06 Hours

UNIT - 7

Building and Sustaining Performance Excellence in Organizations : Making the commitment to total quality, organizational culture and total quality, change management, sustaining the quality organization, self-assessment processes, implementing ISO 9000, Bald ridge, and sis sigma, a view toward the future.

07 Hours

UNIT - 8

Design for Six Sigma: Tools for concept development, tools for design development, tools for design optimization, tools for design verification, problems.

06 Hours

TEXT BOOKS:

1. **Total Quality Management:** Dale H. Bester field, Publisher - Pearson Education India, ISBN: 8129702606, Edition 03/e Paperback (Special Indian Edition)
2. **Total Quality Management for Engineers:** M. Zairi, ISBN: 1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. **A New American TQM, four revolutions in management,** Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
2. **100 Methods for Total Quality Management**: Gopal K. Kanji and Mike Asher, ISBN: 0803977476, Publisher: Sage Publications, Inc.; Edition – 1
3. **Organisational Excellence through TQM, H**. Lal, New age pub, 2008

ELECTIVE-II (GROUP C)

EXPERIMENTAL STRESS ANALYSIS

Sub Code	**: 10ME 761**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT-1

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gage construction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits. **06 Hours**

UNIT-2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

06 Hours

UNIT-3

Photo-elasticity: Nature of light, Wave theory of light - optical interference , Stress optic law – effect of stressed model in plane and circular polariscopes, Isoclinics & Isochromatics, Fringe order determination Fringe multiplication techniques, Calibration photoelastic model materials

08 Hours

UNIT-4

Two Dimensional Photo-elasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photo-elastic model materials, Materials for 2D photo-elasticity

06 Hours

PART -B

UNIT-5

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photo-elasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

06 Hours

UNIT-6

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's, Stress separation techniques: Oblique incidence, Strip coatings. **08 Hours**

UNIT-7

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

06 Hours

UNIT-8

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis ,0ut of plane displacement measurements, Out of plane slope measurements .Applications and advantages

06 Hours

TEXT BOOKS:

1. **"Experimental Stress Analysis",** Dally and Riley, McGraw Hill.
2. **"Experimental Stress Analysis".** Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata McGraw Hill.

REFERENCES BOOKS :

1. **"Photoelasticity Vol I and Vol II,** M.M.Frocht, John Wiley & sons.
2. **"Strain Gauge Primer",** Perry and Lissner,
3. **"Photo Elastic Stress Analysis",** Kuske, Albrecht & Robertson John Wiley & Sons.
4. **"Motion Measurement and Stress Analysis",** Dave and Adams,

TOOL DESIGN

Sub Code	**: 10ME 762**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT 1

Introduction to tool design: Tooling, requirements of a tool designer, general tool design procedure.

Design of Single point Cutting Tools: Design of single point lathe tool: Design of shank dimension using strength and rigidity considerations for rectangular, square and round cross section and selection of tool geometry. Solid type tool, brazed tip tool, long index able insert, throwaway index able insert types and chip breakers.

06 Hours

UNIT 2

Design of Multi Point Cutting Tool: Drill bit design of elements like back taper, web thickness, land width, margin, flute length and cross section and selection of tool geometry. Design of milling cutter: Design of elements like number of teeth and height circular pitch, body thickness, chamfer width, fillet radius and selection of tool geometry.

04 Hours

UNIT 3

Design of Jigs : Functions and differences between jigs and fixtures, advantages in mass production, design principles, economics of jigs and fixtures. Principles of location -3-2-1 and 4-1-1 types of locations, different types of locating elements. Clamping – Principles of clamping, types of clamping including power clamping devices. Drill jigs- Types, Drill bushes, simple exercises of designing jigs for given components.

05 Hours

UNIT 4

Design of Fixtures: Fixture Design Turning fixtures, milling fixtures, grinding and broaching fixtures, indexing fixtures. Design of fixtures for simple components.

05 Hours

PART - B

UNIT 5

Design of Sheet Metal: Working of a power press and classification of presses. Components of a simple die, press tool operation, die accessories, shearing action in punch & die, clearance, shear on punch and die, Centre of pressure and problems, scrap strip layout. Simple, progressive, compound,

combination and inverted dies. Design problems on blanking and piercing dies for simple components.

05 Hours

UNIT 6

Bending & Drawing: Bending dies – Introduction, bend allowance, spring back, edge bending die design. Drawing dies – Single action, double action and triple action dies, factors affecting drawing, drawing die design.

05 Hours

UNIT 7

Die Casting Dies : Terminology: Core, cavity, sprue, slug, fixed and movable cores, finger cams, draft, ejector pins ejector plates, gate, goose-nozzle, over-flow, platten, plunger, runner, vent, water-line etc. Types of Dies: Single cavity, multicavity dies, combination dies, unit dies, advantages and disadvantages of types of dies. Die casting dies, unit dies. advantages and disadvantages of types of dies. Die casting alloys, defects in die casting, finishing trimming and inspection of die casting components, safety, modern trends in die casting dies.

05 Hours

UNIT 8

Injection Molding: Injection moulding machine and its elements, general configuration of a mould. 2 plate and 3 plate mould. Introduction, to gate, runner, parting surface, ejection system. Core and cooling system. Introduction to compression, transfer, blow moulding, extrusion, forming and calendaring.

05 Hours

TEXT BOOKS:

1. **Tool Design**, C. Donaldson, G.H.Le Cain V.C. Goold, Tata McGraw Hill pub.1976.
2. **Metal cutting theory & cutting tool design**, V. Arshinow and G. Alfseev Mir pub. Mascow Edu 1976:

REFERENCE BOOKS:

1. **Introduction to jigs and fixture design**, M H A Kempster, Elbs, Edn. 1974.
2. **Tool engineering and design**, Nagpal Khanna pub.Edn. 1998.
3. **Fundamentals of tool design**, ASTME Prentice Hall India.2000
4. **Metal cutting and tool design**, DR,B,J, Ranga, Vikas Pub. Edn. 1993.
5. **Manufacturing technology (foundry forming and welding)** P.N. Rao, Tata McGraw Hill Pub, Edn.1996
6. **Die Casting Die Design**, Burton 2000
7. **Injection Moulding Design**, RGW Pye, john.1998

8. **Injection Moulding Handbook**, Dominick V. Rosato & Donald V. Rosato, 1996, CBS Publishers

Scheme of Examination:

1. Eight questions to be set selecting FOUR questions from each Part
2. Each question carries 20 marks.
3. Five questions to be solved selecting at least two question from each Part

CRYOGENICS

Sub Code	**: 10ME 763**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction To Cryogenic Systems: Applications Areas of Cryogenic Engineering

Low temperature properties of engineering materials – Mechanical properties, Thermal properties, Electrical properties.

Introduction The Thermodynamically Ideal system Production of low temperatures – Joule Thompson Effect, Adiabatic expansion.

06 Hours

UNIT - 2

Gas Liquification Systems: Liquification systems for Air Simple Linde – Hampson System, Claude System, Heylndt System, Dual pressure, Claude.

Liquefaction cycle Kapitza System. Comparison of Liquefaction Cycles Liquefaction cycle for hydrogen, helium and Neon, Critical components of liquefaction systems.

07 Hours

UNIT - 3

Gas Cycle Cryogenic Refrigeration Systems: Classification of Cryo coolers Stirling cycle Cryo – refrigerators, Ideal cycle – working principle. Schmidt's analysis of Stirling cycle Various configurations of Stirling cycle refrigerators Integral piston Stirling cryo-cooler, Free displacer split type Stirling Cryo coolers, Gifford Mcmahon Cryo- refrigerator, Pulse tube refrigerator, Solvay cycle refrigerator, Vuillimier refrigerator, Cryogenic regenerators.

06 Hours

UNIT - 4

Gas Separation And Gas Purification Systems: Thermodynamic ideal separation system, Properties of mixtures, Principles of gas separation, Linde

single column air separation. Linde double column air separation, Argon and Neon separation systems. Adsorption Process, PSA systems.

07 Hours

PART - B

UNIT - 5

Ultra Low Temperature Cryo – Refrigerators: Magneto Caloric Refrigerator ^{3}He-^{4}He Dilution refrigerator. Pomeranchuk cooling.

Measurement systems for low temperatures, Temperature measurement at low temperatures, Resistance thermometers, Thermocouples, Thermistors, Gas Thermometry. Liquid level sensors.

06 Hours

UNIT - 6

Vacuum Technology: Fundamental principles. Production of high vacuum, Mechanical vacuum pumps, Diffusion pumps, Cryo-pumping, Measurement of high vacuum level.

Cryogenic Insulation: Heat transfer due to conduction, Evacuated porous insulation Powder & Fibers Opacified powder insulation, Gas filled powders & Fibrous materials Multilayer super-insulation, Composite insulation.

07 Hours

UNIT - 7

Cryogenic Fluid Storage And Transfer Systems: Design of cryogenic fluid storage vessels, Inner vessel, Outer Insulation, Suspension system, Fill and drain lines. Cryogenic fluid transfer, External pressurization, Self pressurization, Transfer pump.

07 Hours

UNIT - 8

Application Of Cryogenic Systems: Cryogenic application for food preservation – Instant Quick Freezing techniques 11.2 Super conductive devices, Cryogenic applications for space technology.

06 Hours

TEXT BOOKS:

1. **Cryogenic Systems,** Randall Barron – Oxford Press, 1985
2. **Cryogenic Engineering,** Thomas M. Flynn, Marcel Dekker, Inc N.Y. Basal 1997

REFERENCE BOOK:

1. **Cryogenic Process Engineering,** Klaus D. Timmerhaus & Thomas M. Flynn, Plenum Press, New York & London 1989.

SMART MATERIALS

Sub Code	**: 10ME 764**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: Characteristics of composites and ceramics materials, Dynamics and controls, concepts, Electro-magnetic materials and shape memory alloys-processing and characteristics

06 Hours

UNIT - 2

Sensing And Actuation: Principals of electromagnetic, acoustics, chemical and mechanical sensing and actuation, Types of sensors and their applications, their compatibility writer conventional and advanced materials, signal processing, principals and characterization.

07 Hours

UNIT - 3

Control Design: Design of shape memory alloys, Types of MR fluids, Characteristics and application, principals of MR fluid value designs, Magnetic circuit design, MR Dampers, Design issues.

06 Hours

UNIT - 4

Optics And Electromagnetic: Principals of optical fiber technology, characteristics of active and adaptive optical system and components, design and manufacturing principles.

07 Hours

PART - B

UNIT - 5

Structures: Principles of drag and turbulence control through smart skins, applications in environment such as aerospace and transportation vehicles, manufacturing, repair and maintainability aspects.

07 Hours

UNIT - 6

Controls: Principles of structural acoustic control, distributed, amalog and digital feed back controls, Dimensional implications for structural control.

06 Hours

UNIT - 7

Principles Of Vibration And Modal Analysis: PZT Actuators, MEMS, Magnetic shape Memory Alloys, Characteristics and Applications.

07 Hours

UNIT - 8

Information Processing: Neural Network, Data Processing, Data Visualisation and Reliability – Principals and Application domains.

06 Hours

TEST BOOKS:

1. **Analysis and Design',** A. V. Srinivasan, 'Smart Structures – Cambridge University Press, New York, 2001, (ISBN : 0521650267)
2. **'Smart Materials and Structures',** M V Gandhi and B S Thompson Chapmen & Hall, London, 1992 (ISBN : 0412370107)

REFERENCE BOOKS:

1. **'Smart Materials and Structures',** Banks HT, RC Smith, Y Wang, Massow S A, Paris 1996
2. **G P Gibss'Adaptive Structres',** Clark R L, W R Saunolers, Jhon Wiles and Sons, New York, 1998
3. **An introduction for scientists and Engineers',** Esic Udd, Optic Sensors : Jhon Wiley & Sons, New York, 1991 (ISBN : 0471830070)

AGILE MANUFACTURING

Sub Code	**: 10ME 765**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Agile Manufacturing: Definition, business need, conceptual frame work, characteristics, generic features.

06 Hours

UNIT - 2

Developing Agile Manufacturing: Enterprise, Strategies, integration of organization, workforce and technology, reference models, examples.

07 Hours

UNIT - 3

Integration Of Product /Process Development: Principles, Robust design approach, Approaches to enhance ability in manufacturing, Role of QFD, Managing people in Agile orgnisation, Approaches.

06 Hours

UNIT - 4

Application Of It/Is Concepts In Agile Manufacturing: Strategies, Management of complexities and information. flow, approaches, applications of multimedia to improve agility in manufacturing, system concepts.

07 Hours

PART - B

UNIT - 5

Agile Supply Chain Management: Principles, IT/IS concepts in supply chain management, enterprise integration and management in agile manufacturing, concepts, Agility, Adaptability and learners – comparison of concepts.

07 Hours

UNIT - 6

Computer Control Of Agile Manufacturing: CAPP for Agile Manufacturing, Aggregate capacity planning and production line design / redesign in Agile manufacturing, Cellular manufacturing, concepts, examples.

07 Hours

UNIT - 7

Corporate Knowledge Management In Agile Manufacturing: Strategies, strategic options in Agile manufacturing, Role of standards.

06 Hours

UNIT - 8

Design Of Skill & Knowledge: Enhancing technology for Machine tool system, Resumption of design requirement geometry, definition, methods, decision support for selection of cutting parameters, design enhancements, parametric approach only.

06 Hours

TEXT BOOKS:

1. **'Agile Manufacturing**- Forging Mew Frontiers', **Poul T Kidd,** Amagow Co. UK, ISBN-0-201-63163-6, 1994
2. **''Agile Manufacturing",** A Gunasekharan, the 21st Century Competitive strategy, ISBN -13 978-0-08-04 3567-1, Elsevier Press, India

REFERENCE BOOKS:

1. **O Levine Transitions to Agile Manufacturing,** Joseph C Moutigomery and Lawrurence – Staying Flexible for competitive advantage, ASQC quality press, Milwaukee. Wisconsiw, USA 1996
2. **Agile Development for Mass Customization,** David M Andeson and B Joseph Pine, Irwin Professional Publishing, Chicogo USa 1997

ROBOTICS

Sub Code	**: 10ME 766**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction and Mathematical Representation of Robots: History of Robots, Types of Robots, Notation, Position and Orientation of a Rigid Body, Some Properties of Rotation Matrices, Successive Rotations, Euler Angles For fixed frames X- Y -Z and moving frame ZYZ. Transformation between coordinate system, Homogeneous coordinates, Properties of A/BT, Types of

Joints: Rotary, Prismatic joint, Cylindrical joint, Spherical joint, Representation of Links using Denvit - Hartenberg Parameters: Link parameters for intermediate, first and last links, Link transformation matrices, Transformation matrices of 3R manipulator, PUMA560 manipulator, SCARA manipulator

07 Hours

UNIT - 2

Kinematics of Serial Manipulators: Direct kinematics of 2R, 3R, RRP, RPR manipulator, puma560 manipulator, SCARA manipulator, Stanford arm, Inverse kinematics of 2R, 3R manipulator, puma560 manipulator.

06 Hours

UNIT - 3

Velocity and Static's of Manipulators: Differential relationships, Jacobian, Differential motions of a frame (translation and rotation), Linear and angular velocity of a rigid body, Linear and angular velocities of links in serial manipulators, 2R, 3R manipulators, Jacobian of serial manipulator, Velocity ellipse of 2R manipulator, Singularities of 2R manipulators, Statics of serial manipulators, Static force and torque analysis of 3R manipulator, Singularity in force domain.

07 Hours

UNIT - 4

Dynamics of Manipulators: Kinetic energy, Potential energy, Equation of motion using Lagrangian, Equation of motions of one and two degree freedom spring mass damper systems using Lagrangian formulation, Inertia of a link, Recursive formulation of Dynamics using Newton Euler equation, Equation of motion of 2R manipulator using Lagrangian Newton-Euler formulation.

06 Hours

PART-B

UNIT - 5

Trajectory Planning: Joint space schemes, cubic trajectory, Joint space schemes with via points, Cubic trajectory with a via point, Third order polynomial trajectory planning, Linear segments with parabolic blends, Cartesian space schemes, Cartesian straight line and circular motion planning

07 Hours

UNIT - 6

Control: Feedback control of a single link manipulator- first order, second order system, PID control, PID control of multi link manipulator, Force control of manipulator, force control of single mass, Partitioning a task for force and position control- lever, peg in hole Hybrid force and position controller.

08 Hours

UNIT - 7

Actuators: Types, Characteristics of actuating system: weight, power-to-weight ratio, operating pressure, stiffness vs. compliance, Use of reduction gears, comparision of hydraulic, electric, pneumatic actuators, Hydraulic actuators, proportional feedback control, Electric motors: DC motors, Reversible AC motors, Brushles DC motors, Stepper motors- structure and principle of operation, stepper motor speed-torque characteristics

06 Hours

UNIT - 8

Sensors: Sensor characteristics, Position sensors- potentiometers, Encoders, LVDT, Resolvers, Displacement sensor, Velocity sensor-encoders, tachometers, Acceleration sensors, Force and Pressure sensors piezoelectric, force sensing resistor, Torque sensors, Touch and tactile sensor, Proximity sensors-magnetic, optical, ultrasonic, inductive, capacitive, eddy-current proximity sensors.

05 Hours

TEXT BOOKS:

1. **Fundamental Concepts and Analysis,** Ghosal A., Robotics, Oxford,2006
2. **Introduction to Robotics Analysis, Systems, Applications**, Niku, S. B., Pearso Education, 2008

REFERENCE BOOKS:

1. **Introduction to Robotics: Mechanica and Control,** Craig, J. J., 2nd :J?:dition, Addison-Welsey, 1989.
2. **Fundamentals of Robotics, Analysis and Control**, Schilling R. J., PHI, 2006

FINANCIAL MANAGEMENT

Sub Code	**: 10ME 767**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction To Financial Management: Forms of organization, direct and indirect taxes. Statutory Registration- excise Duty, central sales tax, VAT, service tax, international fund availability.

06 Hours

UNIT - 2

Risk And Required Return: Risk and return relationship, methods of measuring the risk, Business risk, financial risk, calculation of expected rate of return to the portfolio, numerical problems.

06 Hours

UNIT - 3

Working Capital Management: Definition, need and factors influencing the working capital requirement. Determination of operating cycle, cash cycle and operating cycle analysis. Calculation of gross working capital and net working capital requirement.

07 Hours

UNIT - 4

Long Term Financing: Raising of finance from primary and secondary markets. Valuation of securities, features of convertible securities and warrants. Features of debt, types of debt instruments, return on investment(ROI) and credit rating of units. Shares, debentures.

07 Hours

PART - B

UNIT - 5

Introduction: Book keeping – systems of book keeping, journal and ledger posting. Financial Statement, Preparation of Trial balance, profit and Loss Account, Balance Sheet with adjustments.

07 Hours

UNIT - 6

Ratio Analysis / Accounting Ratio: Liquidity ratio – Current ratio, quick ratio, turnover ratio, capital structure ratio- Debt – equity ratio, Coverage ratio, Profitability ratio, Profit margin, Return on assets, Activity ratios – Inventory turnover ratio, Debtors Turnover ratio. Preparation of the balance sheet from various ratios. Analysis of any one published balanced sheet.

07 Hours

UNIT - 7

Costing: Classification of cost, preparation of cost sheet, absorption and variable costing, job costing, process costing. Classification of the variances analysis – material, labour and overhead variances.

06 Hours

UNIT - 8

Budgeting: Types of budgets – Flexible budgets, preparation of cash budgets, purchase and production budgets and master budget, Budgetory control, advantages & limitations of budgeting.

06 Hours

TEXT BOOKS:

1. **Financial Management,** Khan & Jain, text & problems, 5th Ed., TMH ISBN 0-07-460208-A. 20001
2. **Financial Accounting, Costing and Management Accounting,** S. M. Maheshwari, 2000

REFERENCE BOOKS:

1. **Financial Management,** I. M. Pandey, Vikas Publication House ISBN 0-7069-5435-1. 2002
2. **Financial Management,** Abrish Gupta, Pearson.
3. **Financial Decision Making,** Humpton. 2000
4. **Financial Management,** Theory and Practice, Prasanna Chandra TMH ISGN -07-462047-9, 3rd edition 2002

MICRO AND SMART SYSTEMS TECHNOLOGY

Sub Code	**: 10ME 768**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction To Micro And Smart Systems:

a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

b) What are microsystems? Feynman's vision. Micromachined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products.

05 Hours

UNIT - 2

Micro And Smart Devices And Systems: Principles And Materials:

a) Definitions and salient features of sensors, actuators, and systems.

b) Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conductometric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor.

c) Actuators: silicon micro-mirror arrays, piezo-electric based inkjet print-head, electrostatic comb-drive and micromotor, magnetic micro relay, shape-memory-alloy based actuator, electro-thermal actuator

d) Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin

08 Hours

UNIT - 3

Micro-Manufacturing And Material Processing:

a) Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization.

b) Silicon micromachining: surface, bulk, moulding, bonding based process flows.

c) Thick-film processing:

d) Smart material processing:

e) Processing of other materials: ceramics, polymers and metals

f) Emerging trends

07 Hours

UNIT - 4

Modeling:

a) Scaling issues.

b) Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading. Heat transfer issues. Basic fluids issues.

c) Electrostatics. Coupled electromechanics. Electromagnetic actuation. Capillary electro-phoresis. Piezoresistive modeling. Piezoelectric modeling. Magnetostrictive actuators.

06 Hours

PART - B

UNIT - 5

Computer-Aided Simulation And Design:

Background to the finite element method. Coupled-domain simulations using Matlab. Commercial software.

08 Hours

UNIT - 6

Electronics, Circuits And Control:

Carrier concentrations, semiconductor diodes, transistors, MOSFET amplifiers, operational amplifiers. Basic Op-Amp circuits. Charge-measuring circuits. Examples from microsystems. Transfer function, state-space modeling, stability, PID controllers, and model order reduction. Examples from smart systems and micromachined accelerometer or a thermal cycler.

08 Hours

UNIT - 7

Integration And Packaging Of Microelectro Mechanical Systems:

Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low-temperature-cofired-ceramic (LTCC) multi-chip-module technology. Microsystem packaging examples.

06 Hours

UNIT - 8

Case Studies:

BEL pressure sensor, thermal cycler for DNA amplification, and active vibration control of a beam.

04 Hours

PART - C

UNIT - 9

Mini-projects and class-demonstrations (not for Examination)

09 Hours

a) CAD lab (coupled field simulation of electrostatic-elastic actuation with fluid effect)
b) BEL pressure sensor
c) Thermal-cycler for PCR
d) Active control of a cantilever beam

TEXT BOOKS AND A CD-SUPPLEMENT:

1. "Micro and Smart Systems" by Dr. A.K.Aatre, Prof. Ananth Suresh, Prof.K.J.Vinoy, Prof. S. Gopalakrishna,, Prof. K.N.Bhat.,John Wiley Publications
2. **MEMS & Microsystems: Design and Manufacture,** Tai-Ran Tsu, Tata Mc-Graw-Hill.

REFERENCE BOOKS:

1. Animations of working principles, process flows and processing techniques, A CD-supplement with Matlab codes, photographs and movie clips of processing machinery and working devices.
2. **Laboratory hardware kits for** (i) BEL pressure sensor, (ii) thermal-cycler and (iii) active control of a cantilever beam.

3. **Microsystems Design,** S. D. Senturia, 2001, Kluwer Academic Publishers, Boston, USA. ISBN 0-7923-7246-8.
4. **Analysis and Design Principles of MEMS Devices,** Minhang Bao, Elsevier, Amsterdam, The Netherlands, ISBN 0-444-51616-6.
5. **Design and Development Methodologies,** Smart Material Systems and MEMS: V. Varadan, K. J. Vinoy, S. Gopalakrishnan, Wiley.
6. **MEMS-** Nitaigour Premchand Mahalik, TMH 2007

OPERATION MANAGEMENT

Sub Code	**: 10ME 81**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART – A

UNIT 1

Production and Operations Management: Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity, contemporary issues and development

06 Hours

UNIT 2

Decision Making: The decision process, characteristics of operations decisions, use of models, decision making environments, graphical linear programming, analysis and trade-offs.

06 Hours

UNIT 3

Forecasting: Steps in forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, accuracy and control of forecasts, choosing a forecasting technique, elements of a good forecast,

07 Hours

UNIT 4

Capacity & Location Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.

07 Hours

PART – B

UNIT 5

Aggregate Planning & Master Scheduling: Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, Master scheduling methods.

08 hours

UNIT 6

Inventory Management: Types of Inventories, independent and dependent demand, reasons for holding inventory, objectives of inventory control, requirements for effective inventory management – information, cost, priority system. Inventory control and economic-order-quantity models.

06 Hours

UNIT 7

Material Requirement Planning (MRP): Dependent versus independent demand, an overview of MRP – MRP inputs and outputs, MRP processing, An overview of MRP-II and ERP capacity requirement planning, benefits and limitations of MRP.

07 Hours

UNIT 8

Purchasing and Supply Chain Management (SCM): Introduction, Importance of purchasing and SCM, The procurement process, Concept of tenders, Approaches to SCM, Vendor development, Measures of purchasing and SCM, Make or buy decision, Types of buying, E-procurement.

06 Hours

TEXT BOOK:

1. **Production and Operations Management**, William J Stevenson, 9th Ed., Tata McGraw Hill.
2. **Operations Management-Theory and Practice**, B Mahadevan, Pearson Education, 2007.

REFERENCES:

1. **Production and Operations Management,** Norman Gaither & Greg Frazier,
2. **Operations Management for Competitive Advantage**, R.B.Chase, N.J.Aquilino, F. Roberts Jacob; McGraw Hill Companies Inc., Ninth Edition.
3. **Production & Operations Management**, Everett E.Adams, Ronald J.Ebert, Prentice Hall of India Publications, Fourth Edition.

4. **Production / Operations Management**, Joseph G Monks, McGraw Hill Books

CONTROL ENGINEERING

Sub Code	**: 10ME 82**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers- Proportional, Integral Proportional Integral, Proportional Integral Differential controllers.

07 Hrs

UNIT- 2

Mathematical Models: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems, pneumatic system, Analogous systems: Force voltage, Force current.

06 Hrs

UNIT - 3

Block Diagrams and Signal Flow Graphs: Transfer Functions definition, function, block representation of systems elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

07 Hrs

UNIT- 4

Transient and Steady State Response Analysis: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

06 Hrs

PART -B

UNIT - 5

Frequency Response Analysis: Polar plots, Nyquist stability criterion, Stability analysis, Relative stability concepts, Gain margin and phase margin, M&N circles.

06 Hrs

UNIT - 6

Frequency Response Analysis Using Bode Plots: Bode attenuation diagrams, Stability analysis using Bode plots, Simplified Bode Diagrams.

07 Hrs

UNIT - 7

Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots.

06 Hrs

UNIT 8

System Compensation and State Variable Characteristics of Linear Systems: Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

07 Hrs

TEXT BOOKS :

1. **Modern Control Engineering,** Katsuhiko Ogatta, Pearson Education,2004.
2. **Control Systems Principles and Design,** M.Gopal, 3rd Ed., TMH,2000.

REFERENCE BOOKS :

1. **Modern Control Systems**, Richard.C.Dorf and Robert.H.Bishop, Addison Wesley,1999
2. **System dynamics & control**, Eronini-Umez, Thomson Asia pte Ltd. singapore, 2002.
3. **Feedback Control System**, Schaum's series. 2001.

ELECTIVE-II (GROUP - D)

TRIBOLOGY

Sub Code	**: 10ME 831**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction To Tribology: Properties of oils and equation of flow: Viscosity, Newton's Law of viscosity, Hagen-Poiseuille Law, Flow between

parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants. **06 Hours**

UNIT - 2

Hydrodynamic Lubrication: Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, mechanism of pressure development in an oil film, Reynold's investigation and Reynold's equation in 2D.

06 Hours

UNIT - 3

Idealized Journal Bearing: introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's numbers and significance of it; Partial bearings, end leakages in journal bearing, numerical problems.

07 Hours

UNIT - 4

Slider / Pad Bearing With A Fixed And Pivoted Shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, numerical examples.

07 Hours

PART - B

UNIT - 5

Oil Flow And Thermal Equilibrium Of Journal Bearing: Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings.

06 Hours

UNIT - 6

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing.

06 Hours

UNIT - 7

Bearing Materials: Commonly used bearings materials, properties of typical bearing materials. Advantages and disadvantages of bearing materials.

07 Hours

UNIT - 8

Behavior Of Tribological Components: Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure. Tribological measures, Material selection, improved design, surface engineering

07 Hours

TEXT BOOKS:

1. **Fundamentals of Tribology** , Basu S K., Sengupta A N., Ahuja B. B., , PHI 2006

2. **Introduction to Tribology Bearings,** Mujumdar B. C., S. Chand company pvt. Ltd 2008.

REFERENEC BOOKS:

1. **Theory and Practice of Lubrication for Engineers,** Fuller, D., New York company 1998
2. **Principles and Applications of Tribology,** Moore, Pergamaon press 1998
3. **Tribology in Industries,** Srivastava S., S Chand and Company limited, Delhi 2002
4. **Lubrication of bearings – Theoretical Principles and Design,** Redzimovskay E I., Oxford press company 2000

FRACTURE MECHANICS

Sub Code	**: 10ME 832**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Fracture Mechanics Principles: Introduction, Mechanisms of Fracture, a crack in structure, the Griffith's criterion, modern design – strengths, stiffness and toughness. Stress intensity approach

06 Hours

UNIT - 2

Stress Analysis For Members With Cracks: Linear elastic fracture mechanics, Crack tip stress and deformations, Relation between stress intensity factor and fracture toughness, Stress intensity based solutions. Crack tip plastic zone estimation, Plane stress and plane strain concepts. The Dugdale approach, the thickness effect.

07 Hours

UNIT - 3

Elastic – Plastic Fracture Mechanics: Introduction, Elasto–plastic factor criteria, crack resistance curve, J-integral, Crack opening displacement, crack tip opening displacement. Importance of R-curve in fracture mechanics, experimental determination of J-integral, COD and CTOD.

07 Hours

UNIT - 4

Dynamic And Crack Arrest: Introduction, the dynamic stress intensity and elastic energy release rate, crack branching, the principles of crack arrest, the dynamic fracture toughness.

06 Hours

PART - B

UNIT - 5

Fatigue And Fatigue Crack Growth Rate: Fatigue loading, various stages of crack propagation, the load spectrum, approximation of the stress spectrum, the crack growth integration, fatigue crack growth laws.

07 Hours

UNIT - 6

Fracture Resistance Of Materials: Fracture criteria, fatigue cracking criteria, effect of alloying and second phase particles, effect of processing and anisotropy, effect of temperature, closure.

06 Hours

UNIT - 7

Computational Fracture Mechanics: Overview of numerical methods, traditional methods in computational fracture mechanics – stress and displacement marching, elemental crack advance, virtual crack extension, the energy domain integral, finite element implementation. Limitations of numerical fracture analysis.

07 Hours

UNIT - 8

Fracture Toughness Testing Of Metals: Specimen size requirements, various test procedures, effects of temperature, loading rate and plate thickness on fracture toughness. Fracture testing in shear modes, fatigue testing, NDT methods.

06 Hours

TEXT BOOKS:

1. **Introduction to Fracture Mechanics**, Karen Hellan McGraw Hill Pub.2000
2. **Fracture of Engineering Brittle Materials,** Jayatilake, Applied Science, London. 2001.

REFERENCE BOOKS:

1. **Fracture Mechanics – Fundamentals and Application,** T.L. Anderson, CRC press 1998
2. **Elementary Engineering Fracture Mechanics**, David Broek, Artinus Nijhoff, London 1999.
3. **Fracture and Fatigue Control in Structures**, Rolfe and Barsom, Printice Hall 2000.

4. **Fundamentals of Fracture Mechanics**, Knott, Bureworth 2000.

POWER PLANT ENGINEERING

Sub Code	**: 10ME 833**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT 1

Steam Power Plant:

Different types of fuels used for steam generation, Equipment for burning coal in lump form, strokers, different types, Oil burners, Advantages and Disadvantages of using pulverised fuel, Equipment for preparation and burning of pulverised coal, unit system and bin system. Pulverised fuel furnaces, cyclone furnace.

7 Hrs

UNIT 2

Coal, Ash Handling and Different Types of Boilers :

Coal and Ash handling, Generation of steam using forced circulation, high and supercritical pressures, A brief account of L Mont, Benson, Velox, Schmidt, Loeffer and Ramson steam generators.

6 Hrs

UNIT 3

Chimneys, Accessories for the Steam Generator Cooling Towers And Ponds:

Natural, forced, induced and balanced draft, Calculations involving height of chimney to produce a given draft. Accessories For The Steam Generator such as super-heaters, desuperheater, control of super heaters, Economisers, Air Pre-heaters Study of different types of cooling towers and ponds.

6 Hrs

UNIT 4

Diesel Engine and Gas Turbine Power Plant:

Method of starting diesel engines, Cooling and lubrication system for the diesel engine. Filters, centrifuges, Oil heaters, Intake and exhaust system, Layout of a diesel power plant.Advantages and disadvantages of the gas turbine plant, Open and closed cycle turbine plants with the accessories.

7Hrs

PART – B

UNIT 5

Hydro-Electric Plants: Storage and pondage, flow duration and mass curves, hydrographs, Low, medium and high head plants, pumped storage plants, Penstock, water hammer, surge tanks, gates and valves, power house,

general layout. A brief description of some of the important Hydel Installations in India.

7Hrs

UNIT 6

Nuclear Power Plant: Principles of release of nuclear energy Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the Nuclear reactor, Moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types - Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Radio active waste disposal.

7 Hrs

UNIT 7

Choice of site for power station, load estimation, load duration curve, load factor, capacity factor, use factor, diversity factor, demand factor, Effect of variable load on power plant, selection of the number and size of units.

6 Hrs

UNIT 8

Economic Analysis of power plant: Cost of energy production, selection of plant and generating equipment, performance and operating characteristics of power plants, tariffs for electrical energy.

6 Hrs

TEXT BOOKS:

1. **Power Plant Engineering**, P.K Nag, 3rd Ed. Tata McGraw Hill2nd ed 2001,
2. **Power Plant Engineering.** Morse F.T., Van Nstrand.1998

REFERENCE BOOKS:

1. **Water Power Engg**., Edition 3, Barrows, TMH, New Delhi. 1998
2. **Plant Engg. Hand Book**, Stanier, McGraw Hill. 1998
3. **Hydraulic Machines**, Jagadish Lal, Metropollitan Co 1996.
4. **Principles of Energy Conversion**, A.W. Culp Jr., McGraw Hill. 1996
5. **Power Plant Technology**, M.M. EL-Wakil, McGraw Hill, International. 1994
6. **Power Station Engg. Economics**, Skrotizke and V opat. 1994
7. **Power Plant Engineering,** Domakundawar, Dhanpath Rai sons.2003

NANO TECHNOLOGY

Sub Code	**: 10ME 834**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

An Overview Of Nano-Science & Nanotechnology – historical background – nature, scope and content of the subject – multidisciplinary aspects – industrial, economic and societal implications.

05 Hours

UNIT - 2

Experimental Techniques And Methods for investigating and manipulating materials in the nano scale – electron microscope – scanning probe microscope – optical and other microscopes – light scattering – x-ray diffraction.

07 Hours

UNIT - 3

Fullerenes – discovery, synthesis and purification – chemistry of fullerenes in the condensed phase – orientational ordering – pressure effects – conductivity and superconductivity – ferromagnetism – optical properties.

Carbon Nanotubes – synthesis and purification – filling of nanotubes – mechanism of growth – electronic structure – transport properties – mechanical and physical properties – applications.

07 Hours

UNIT - 4

Self-Assembled Monolayers – monolayers on gold – growth process – phase transitions – patterning monolayers – mixed monolayers – applications.

GAS PHASE CLUSTERS – history of cluster science – formation and growth – detection and analysis – type and properties of clusters – bonding in clusters.

07 Hours

PART - B

UNIT - 5

Semiconductor Quantum Dots – synthesis – electronic structure of nanocrystals – how quantum dots are studied – correlation of properties with size – uses.

05 Hours

UNIT - 6

Monolayer-Protected Metal Nanoparticles – method of preparation– characterization – functionalized metal nanoparticles – applications – superlattices.

Core-Shell Nanoparticles – types – characterization – properties – applications.

Nanoshells – types – characterization – properties – applications.

08 Hours

UNIT - 7

Nanobiology – interaction between biomolecules and nanoparticle surfaces – materials used for synthesis of hybrid nano-bio assemblies – biological applications – nanoprobes for analytical applications – nanobiotechnology – future perspectives. **Nanosensors** – what make them possible – nanoscale organization for sensors – characterization – nanosensors based on optical properties – nanosensors based on quantum size effects – electrochemical sensors – sensors based on physical properties – nanobiosensors – sensors of the future.

Nanomedicines – approach to development – nanotechnology in diagnostic and therapeutic applications.

08 Hours

UNIT - 8

Molecular Nanomachines – covalent and non-covalent approaches – molecular motors and machines – other molecular devices – single molecular devices – practical problems involved.

Nanotribology – studying tribology on the nanoscale – applications.

05 Hours

TEXT BOOKS:

1. **NANO: The Essentials – Understanding Nanoscience and Nanotechnology;** T Pradeep (Professor, IIT Madras); Tata McGraw-Hill India (2007)
2. **Nanotechnology:** Richard Booker & Earl Boysen; Wiley (2005).

REFERENCE BOOKS:

1. **Introduction to Nanoscale Science and Technology [Series: Nanostructure Science and Technology],** Di Ventra, et al (Ed); Springer (2004)
2. **Nanotechnology Demystified,** Linda Williams & Wade Adams; McGraw-Hill (2007)
3. **Introduction to Nanotechnology,** Charles P Poole Jr, Frank J Owens, Wiley India Pvt. Ltd., New Delhi, 2007.

ORGANIZATIONAL BEHAVIOUR & PROFESSIONAL COMMUNICATION

Sub Code	**: 10ME 835**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: Definition of Organization Behaviour and Historical development, Environmental context (Information Technology and Globalization, Diversity and Ethics, Design and Cultural, Reward Systems).

06 Hours

UNIT - 2

The Individual: Foundations of individual behaviour, individual differences. Ability. Attitude, Aptitude, interests. Values.

07 Hours

UNIT - 3

Learning: Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social learning theory, continuous and intermittent reinforcement.

07 Hours

UNIT - 4

Perception: Definition, Factors influencing perception, attribution theory, selective perception, projection, stereotyping, Halo effect**.**

07 Hours

PART - B

UNIT - 5

Motivation: Maslow's Hierarchy of Needs theory, Mc-Gregor's theory X and Y, Hertzberg's motivation Hygiene theory, David Mc-Clelland's three needs theory, Victor Vroom's expectancy theory of motivation**.**

06 Hours

UNIT - 6

The Groups: Definition and classification of groups, Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making**.**

06 Hours

UNIT - 7

Conflict & Stress Management: Definition of conflict, functional and dysfunctional conflict, stages of conflict process**.** Sources of stress, fatigue

and its impact on productivity. Job satisfaction, job rotation, enrichment, job enlargement and reengineering work process**.**

08 Hours

UNIT - 8

Principles Of Communication: Useful definitions, communication principles, communication system, role of communication in management, barriers in communication, how to overcome the barriers, rule of effective communication**.**

06 Hours

TEXT BOOKS:

1. **Organizational Behaviour,** Stephen P Robbins, 9th Edition, Pearson Education Publications, ISBN-81-7808-561-5 2002
2. **Organizational Behaviour,** Fred Luthans, 11th Edition, Mc Graw Hill International Edition, ISBN-0-07-120412-12002

REFERENCE BOOKS:

1. **Organizational Behaviour,** Hellriegel, Srocum and Woodman, Thompson Learning, 9th Edition, Prentice Hall India, 2001
2. **Organizational Behaviour,** Aswathappa - Himalaya Publishers. 2001
3. **Organizational Behaviour,** VSP Rao and others, Konark Publishers.2002
4. **Organizational Behaviour,** (Human behaviour at work) 9th Edition, John Newstron/ Keith Davis. 2002

COMPUTER GRAPHICS

Sub Code	**: 10ME 836**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Scan Conversion and Clipping Representation of points, lines, Line Drawing Algorithms: DDA algorithm, Bresenham's integer line algorithm,

Bresenham's circle algorithm, mid point line and circle, Polygon filling algorithms: scan conversion, seed filling, scan line algorithm. Viewing transformation, Clipping –points, lines, text, polygon, Cohen-Sutherland line clipping, Sutherland-Hodgmen algorithm.

07 Hours

UNIT - 2

Two Dimensional Transformations Representation of points, Transformations: Rotation, Reflection, Scaling, Combined Transformations, Translations and Homogeneous Coordinates, A geometric interpretation of homogeneous coordinates, Over all scaling, Points at infinity, rotation about an arbitrary point, Reflection through an arbitrary line.

06 Hours

UNIT - 3

Three Dimensional Transformations and Projections 3D Transformation matrix: general matrix, Translation, scaling, Shearing, Rotation, Reflection, Multiple transformations, Rotation about an axis parallel to coordinate axis, Rotation about an arbitrary axis in space, Reflection through an arbitrary plane, Orthographic, Parallel projection Transformations, one, Perspective projections- one point, two point and three point.

06 Hours

UNIT - 4

Plane and Space Curves Curve representation, Nonparametric curves, parametric curves, parametric representation and generation of line, circle, ellipse, parabola, hyperbola, generation of circle, ellipse, parabola, hyperbola, Cubic spline, normalized cubic splines, Bezier curves: blending function, properties, generation, B-spline curves- Cox-deBoor recursive formula,properties,open uniform basis functions, Non-uniform basis functions, periodic B-spline curve.

07 Hours

PART - B

UNIT - 5

Types and Mathematical Representation of Solids, Solid Models, Solid entities, Solid representation, Solid modeling- set theory, regularized set operations, set membership classification, Half spaces, Half spaces of plane, cylinder, sphere, conical half-space, Boundary representation, Constructive Solid Geometry- basic elements, Building operations.

07 Hours

UNIT - 6

VISUAL REALISM-I: Introduction, hidden line removal- visibility of object views, Visibility techniques: minimax test, containment test, surface test, Silhouttes, Homogeneity test, Sorting, Coherence, Hidden line priority algorithm, Hidden surface removal- Z-buffer algorithm, Warnock's algorithm, Hidden solid removal- ray tracing algorithm.

06 Hours

UNIT - 7

VISUAL REALISM-II: Shading, shading models- diffuse reflection, specular reflection, ambient light, Shading surfaces- constant shading, gourmand shading, Phong shading, Shading enhancements, Shading Solids- Ray tracing for CSG, z- buffer algorithm for B-rep and CSG, octree encoded objects, Colouring- RGB, CMY, HSV, HSL colour models.

07 Hours

UNIT - 8

COMPUTER ANIMATION: Introduction, Conventional animation-key frame, Inbetweening, Line testing, Painting, Filming, Computer animation- entertainment and engineering animation, Animation system hardware, software architecture, Animation types- frame buffer, colour table, zoom-pan-scroll, cross bar, real time play back, Animation techniques- key frame, skelton. Path of motion and p-curves.

06 Hours

TEXT BOOKS:

1 **CAD/CAM-Theory and Practice,** Ibraham Zeid, 2nd Ed., McGraw Hill, 2006

2 **Mathematical Elements for Computer Graphics**, Rogoer's Adams, McGraw Hill. 1990

REFERENCE BOOKS:

1. **Computer Graphics**, Xiang z, Plastock, R. A., Schaums outlines, McGraw Hill. 2007.
2. **Computer Graphics, principles and practice,** .Foley, Van- Damn, Finner and Hughes, Addison Wesley. 2000
3. **Computer Graphics,** Sinha A. N., Udai A. D., Tata McGraw Hill, 2008.
4. **Computer Graphics,** C Version- Doneld Heran, M. Pauline Baker, 2nd Edition, Pearson.

RAPID PROTOTYPING

Sub Code	**: 10ME 837**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.

Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

07 Hours

UNIT - 2

Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications.

Fusion Deposition Modelling: Principle, Process parameter, Path generation, Applications.

07 Hours

UNIT - 3

Solid Ground Curing: Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application.

06 Hours

UNIT - 4

Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems.

06 Hours

PART - B

UNIT - 5

Rapid Tooling: Indirect Rapid tooling, Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, etc. Direct Rapid Tooling Direct. AIM.

06 Hours

UNIT - 6

Rapid Tooling: Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

06 Hours

UNIT - 7

Software For Rp: STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools.

06 Hours

UNIT - 8

Rapid Manufacturing Process Optimization: factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation.

08 Hours

TEXT BOOKS:

1. **Stereo Lithography and other RP & M Technologies,** Paul F. Jacobs: SME, NY 1996.
2. **Rapid Manufacturing,** Flham D.T & Dinjoy S.S Verlog London 2001.

REFERENCE BOOKS:

1. **Rapid Prototyping,** Terry Wohlers Wohler's Report 2000" Wohler's Association 2000.
2. **Rapid Prototyping Materials,** Gurumurthi, IISc Bangalore.
3. **Rapid Automated,** Lament wood. Indus press New York

FOUNDRY TECHNOLOGY

Sub Code	**: 10ME 838**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Foundry Metallurgy: Oxidation of liquid metals, gas dissolution in liquid metals, methods of degassing, fluidity, factors affecting fluidity, fluidity tests, hot tearing, shrinkage of liquid metals.

06 Hours

UNIT - 2

Casting Design: Introduction to casting design, redesign considerations, design for minimum casting stresses, design for directional solidification, design for metal flow, safety factors, design for low pattern cost and model making as an aid in design.

06 Hours

UNIT - 3

Solidification Of Castings: Crystallization and development of cast structure - nucleation, growth and dendritic growth. Structure of castings - significance

and practical control of cast structure, grain shape and orientation, grain size, refinement and modification of cast structure. Concept of progressive and directional solidification, solidification time and derivation of Chvorinov's equation, influence on mold characteristics and cast metal.

07 Hours

UNIT - 4

Risering And Gating: Need for risering, general considerations of risering, riser shapes, riser size, and location. Requirements of a riser. Sand, insulating, and exothermic materials used for risers. Riser feeding distance and theory of risering. Internal chills, external chills, use of mould materials of different chill capacities, padding for directional solidification. Open type and blind risers. Riser treatment using exothermic and insulating compounds. Gating system – theoretical consideration of gating, laws of fluid flow, turbulence in gating system, use of ceramic foam filters in gating, need for tapered sprue, gating ratio, simple problems.

07 Hours

PART - B

UNIT - 5

Special Moulding Techniques: Principles, materials used, process details and application of no-bake sand systems, vacuum moulding, flaskless moulding, and high pressure moulding.

CUPOLA MELTING: Developments in cupola melting – hot blast cupola, water cooled cupola, balanced blast cupola, cokeless cupola, cupola charge calculations.

07 Hours

UNIT - 6

Ferrous Foundry: Melting procedures, casting characteristics, production, specification, and properties of some typical steels, grey cast iron, malleable iron, and spheroidal graphite cast iron castings.

07 Hours

UNIT - 7

Non-Ferrous Foundry: Melting procedures, casting characteristics, production, specification, and properties of some typical aluminum, copper, and magnesium based alloy castings.

06 Hours

UNIT - 8

Modernization And Mechanization Of Foundry: Need for modernization, and mechanization, moulding and core making, melting, pouring, shake out equipment and fettling, dust and fume control, material handling equipments for sand moulds and cores, molten metal and castings, reclamation of sands. Pollution control – norms, and agencies.

06 Hours

TEXT BOOKS:

1. **Principles of metal casting,** Heine Loper & Rosenthal TMH - 2005

2. **Principle of Foundry Technology**, P. L. Jain, 5th Ed., TMH – 2006.

REFERENCE BOOKS:

1. **Castings,** John Campbell, Second edition, Elseivier
2. **Foundry Technology,** P. N. Rao
3. **Manufacturing Process,** I, Dr. K. Radha Krishna 5th Edn. Sapna Book House, Bangalore

ELECTIVE-II (GROUP - E)

MACHINE TOOL DESIGN

Sub Code	**: 10ME 841**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Principles Of Machine Tool Design: General requirements of machine tool design - design process machine tool layout general requirements of machine tool design – design process machine tool layout

05 Hours

UNIT - 2

Machine Tool Drives And Mechanisms: Working and auxiliary motion. Drives- Electric drives, Hydraulic transmission, Kinmatic structure, Regulation of speed and feeds, stepped regulation, standardization of speed and feed, stepless regulation of speeds and feeds.

07 Hours

UNIT - 3

Cutting Force Analysis And Power Requirement: In Turning, Milling, Drilling, Shaping and Broaching operation with simple problems. General requirements of machine tools - Centre lathe, Milling machine.

07 Hours

UNIT - 4

Design Of Machine Tool Structures: Functions-Requirements-Design criteria Material used – static and dynamic stiffness – Profile and basic design procedure for machine tool structures. Design of beds, columns, housing, bases, tables, cross-rails, arms saddle, carriages.

07 Hours

PART - B

UNIT - 5

Design Of Guide Ways And Power Screws: Function and types of guide ways – Design and lubrication of slide ways - aerostatic slide ways - antifriction guide ways, combination guide ways - protecting devices, design of power screws.

06 Hours

UNIT - 6

Design Of Spindle And Spindle Bearings: Functions-Requirements and materials for spindle compliance and machining accuracy. Design of spindles, antifriction bearing, Hydrodynamic and Hydrostatic bearing, Air lubricated bearing.

06 Hours

UNIT - 7

Dynamics Of Machine Tools: Concept of dynamic cutting process, Physical causes of chatter and vibrations, Types of Chatter. Stability chart, chatter vibration in Lathe, Drilling machine, Grinding machine and Milling machine. Different methods for avoiding machine tool chatter and vibration.

07 Hours

UNIT - 8

Control Systems In Machine Tools: Functions, requirements and classification. Control system for speed and feeds centralized control pre selective control, control system for forming and auxiliary motions – Mechanical control– Ergonomic consideration and compatibility – Automatic control system – Electric Hydraulic and pneumatic systems.

07 Hours

TEXT BOOKS:

1. **Machine Tool Design,** N.K. Mehta, 2nd Ed., Tata McGraw Hill 2001
2. **Principles of Machine Tools,** Sen and Bhattacharaya Oxford IBM Publishing 2000

REFERENCE BOOKS:

1. **Machine Tool Design Volume – II and III,** N. Acharkan MIR Publications 2000
2. **Design of Machine Tools**, S. K. Basu and D. K. Pal 2000
3. **Principles of Machine Tool Design**, Koensberger 1993

INDUSTRIAL ENGINEERING AND ERGONOMICS

Sub Code	**: 10ME 842**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Productivity & Work Study: Definition of productivity, factors affecting productivity, definition, objective & scope of work study, human factors in work study, work study & management, work study & supervisor, work study &worker.

06 Hours

UNIT - 2

Method Study: Definition, objective & scope, charts to record movements in shop, process charts, flow process charts, Multiple activity charts, two handed process charts, SIMO chart, principles of motion economy.

08 Hours

UNIT - 3

Work Measurement: Definition, objectives, techniques of work measurement, work sampling, need of confidence levels, sample size determination, random observation with simple problems

06 Hours

UNIT - 4

Time Study: Definition, time study equipments, selection of jobs, steps in time study, breaking jobs into elements, recording information, rating, standard performance, scales of rating, factors affecting rate of working, allowances, standard time determination.

06 Hours

PART - B

UNIT - 5

Introduction To Industrial Design: elements of design structure for industrial design in engineering application in modern manufacturing systems.

Ergonomics and Industrial Design: Introduction, general approach to the man-machine relationship, workstation design-working position.

08 Hours

UNIT - 6

Visual Effects Of Line And Form: The mechanics of seeing-psychology of seeing general influences of line and form.

06 Hours

UNIT - 7

Color Models: RGB, CMY, HSV, Color and light, color and objects-color and the eye-color consistency-color terms reactions to color and color continuation-color on engineering equipments.

06 Hours

UNIT - 8

Aesthetic Concepts: Concept of unity-concept of order with variety-concept of purpose style and environment –Aesthetic expressions. Style –components of style house style, observation style in capital goods, case study.

06 Hours

TEXT BOOKS:

1. **Work study,** ILO, 3rd edition, 2006
2. **Human Factor Engineering**: Sanders & McCormick, 7th Ed., McGraw Hill Publications.

REFERENCE BOOKS:

1. **Applied Ergonomics Hand Book,** Brain Shakel, Butterworth Scientific, London 1988
2. **Introduction to Ergonomics,** R. C. Bridger, McGraw Hill Publications.
3. **Industrial Design for Engineers,** Mayall W. H. London Hiffee Books Ltd., 1988
4. **Work Study & Ergonomics,** Suresh Dalela & Saurabh, standard publishers & distributors,1999

BIOMASS ENERGY SYSTEMS

Sub Code	**: 10ME 843**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: Biomass energy sources, energy content of various Bio – fuels, Energy plantation, origin of Biomass photo synthesis process, Biomass Characteristics, sustainability of Biomass.

06 Hours

UNIT - 2

Biomass Conversion Methods: Agrochemical, Thermochemical, Biochemical (flowchart) & Explanation.

06 Hours

UNIT - 3

Physical & Agrochemical Conversion: Briquetting, Pelletization, Agrochemical, fuel Extraction, Thermo chemical Conversion: Direct combustion for heat, Domestic cooking & heating.

07 Hours

UNIT - 4

Biomass Gasification: Chemical reaction in gasification, Producergas& the constituents, Types of gasifiers. Fixed bed gasifiers, Fluidized bed gasifiers.Liquefaction: Liquefaction through pyrolysis & Methanol synthesis, application of producer gas in I C Engines.

07 Hours

PART - B

UNIT - 5

Bio-Methanization: Anaerobic digestion, Basic principles, factors influencing Biogas yield, classification of Biogas digester, floating gasholder & fixed dome type.(Working Principle with diagram), Calculations for sizing the Biogas plant.

06 Hours

UNIT - 6

Biogas For Power Generation: Ethanol as an automobile fuel, Ethanol production & its use in engines.

06 Hours

UNIT - 7

Bio - Diesel: Bio Diesel from edible & non-edible oils, Production of Bio diesel from Honge & Jatropha seeds, use of bio diesel in I C engines, Engine power using Bio diesel, Blending of Bio diesel, Performance analysis of diesel engines using bio diesel. Effect of use of bio diesel in I C engines.

07 Hours

UNIT - 8

Bio Power Plants: Bio Power generation routes, Basic Thermodynamic cycles in Bio power generation; Brayton cycle, Sterling cycle, Rankine cycle, Co-generation cycle. Biomass based steam power plant.

07 Hours

TEXT BOOKS:

1. **Bio Gas Technology,** B.T. Nijaguna. New Age International- New Delhi.2001-02
2. **Energy Technology,** S. Rao & B. B. Parulekar – Khanna Publishers, Delhi-1999.
3. **Non Conventional Energy Sources,** G. D. Rai - Khanna Publishers. Delhi.

REFERENCE BOOKS:

1. **Greenhouse Technology for Controlled Environment,** G.N. Tiwari, Alpha Science International Ltd., Pangbourne.England.
2. **Renewable Energy Resources,** John.W.Twidell, Anthony. D. Weir, EC BG-2001.
3. **BioMass, Deglisc. X and P. Magne,** Millennium Enterprise, New Delhi.

AUTOMOTIVE ENGINEERING

Sub Code	**: 10ME 844**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Engine Components And Cooling & Lubrication Systems: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, Compression ratio, methods of a Swirl generation, choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements.

07 Hours

UNIT - 2

Fuels, Fuel Supply Systems For Si And Ci Engines: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors.

07 Hours

UNIT - 3

Superchargers And Turbochargers: Naturally aspirated engines, Forced Induction, Types pf superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

06 Hours

UNIT - 4

Ignition Systems: Battery Ignition systems, magneto Ignition system, Transistor assist contacts. Electronic Ignition, Automatic Ignition advance systems.

06 Hours

PART - B

UNIT - 5

Power Trains: General arrangement of clutch, Principle of friction clutches, Torque transmitted, Constructional details, Fluid flywheel, Single plate, multi-plate and centrifugal clutches.

Gear box: Necessity for gear ratios in transmission, synchromesh gear boxes, 3, 4 and 5 speed gear boxes. Free wheeling mechanism, planetary gears systems, over drives, fluid coupling and torque converters, Epicyclic gear box, principle of automatic transmission, calculation of gear ratios, Numerical calculations for torque transmission by clutches.

08 Hours

UNIT - 6

Drive To Wheels: Propeller shaft and universal joints, Hotchkiss and torque tube drives, differential, rear axle, different arrangements of fixing the wheels to rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe in & toe out, condition for exact steering, steering gears, power steering, general arrangements of links and stub axle, over steer, under steer and neutral steer, numerical problems, types of chassis frames.

06 Hours

UNIT - 7

Suspension, Springs And Brakes: Requirements, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel. Air suspension system.

Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical Problems

06 Hours

UNIT - 8

Automotive Emission Control Systems: Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter, Emission standards- Euro I, II, III and IV norms, Bharat Stage II, III norms.

6 Hours

TEXT BOOKS:

1. **Automotive mechanics,** William H Crouse & Donald L Anglin, 10th Edition Tata McGraw Hill Publishing Company Ltd., 2007
2. **Automotive Mechanics,** S. Srinivasan, 2nd Ed., Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. **Automotive mechanics: Principles and Practices**, Joseph Heitner, D Van Nostrand Company, Inc
2. **Fundamentals of Automobile Engineering,** K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
3. **Automobile Engineering**, R. B. Gupta, Satya Prakashan, 4th edn. 1984.
4. **Automobile engineering**, Kirpal Singh. Vol I and II 2002.

DATABASE MANAGEMENT SYSTEM

AUTOMOTIVE ENGINEERING

Sub Code	**: 10ME 845**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Database And Database Users: Introduction, characteristics of database approach, intended uses of a DBMS, advantages and implementation of database approach.

06 Hours

UNIT - 2

Database Systems Concepts And Architecture: Data models, schemes and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.

06 Hours

UNIT - 3

Data Modeling: High level conceptual data models for database design. Entity types, entity sets, attributes and keys, Relationships, relationship types, roles and structural constraints. Weak entity types, ER diagram and design issue.

08 Hours

UNIT - 4

Record Storage And Primary File Organizations: Secondary storage devices, buffering of the blocks, placing file records on the disk, operations on files, heap files and sorted files, hashing techniques.

06 Hours

PART - B

UNIT - 5

Relational Data Model And Relational Algebra: Brief discussion on code rules, relational model concepts, constraints and schemas. Update operation on relations, basic and additional relational algebra operations, queries in relational algebra.

07 Hours

UNIT - 6

Structural Query Language (Sql): Data definition etc., in SQL2. Basic and complex queries in SQL, Inser, Delete; Update statements, and views in SQKL, embedded SQL.

07 Hours

UNIT - 7

Database Design: Design guidelines for relational schemas, functional dependencies, normalization 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th}; normal forms. Database design process, factors influencing physical database design guidelines, and guidelines for relational systems.

07 Hours

UNIT - 8

System Implementation: System catalogue for RDBMSs, transaction processing, and system concepts, properties of transaction, brief discussion on concurrency control and recovery techniques, database security and authorization.

05 Hours

TEXT BOOKS:

1. **Fundamentals of Database Systems,** Ramez Elmasri and Shanmkanth B. Navathe, 3^{rd} Edition, Addison Pearson.
2. **Database Management System,** Raghu Ramakrishnan, Tata Mc Graw Hill, 3^{rd} Edn. 2002.

REFERENCE BOOKS:

1. **Database Management and Design,** Gray W.hansen and James V. Hansen, 2^{nd} Edn. Printice Hall India Pvt. Ltd., 2002.
2. **Database Management Systems,** Designing and Building business applications by Gerald V. Post, 3^{rd} Edition, Tata Mc Graw Hill Publishing company Ltd.,- 2005
3. **Project Mangment with PERT and CPM,** Moder Joseph J and Phillips cerel, R., VAN Noserand, Reinhold, 2^{nd} Edn., 1976.

ARTIFICIAL INTELLIGENCE

Sub Code	**: 10ME 846**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Artificial Intelligence: Introduction, definition, underlying assumption, importance f A1, AI and related fields.

06 Hours

UNIT - 2

Space Representation: Defining a problem. Production systems and its characteristics, Search and Control strategies – Generate and Test, Hill Climbing, Best – first Search, Problem reduction, Constraint Satisfaction, Means – Ends Analysis.

07 Hours

UNIT - 3

Knowledge Representation Issues: Representations and Mappings, Types of knowledge – Procedural Vs Declarative, Logic programming. Forward Vs Backward reasoning, Matching.

07 Hours

UNIT - 4

Use Of Predicate Logic: Representing simple facts, Instance and Isa relationships, Syntax and Semantics for Prepositional logic, FQPL and properties of Wffs, Conversion to Clausal form, Resolution, Natural deduction.

06 Hours

PART - B

UNIT - 5

Statistical And Probabilistic Reasoning: Symbolic reasoning under uncertainty, Probability and Bayes' theorem, Certainity factors and Rule based systems, Bayesian Networks, Shafer Theory, Fuzzy Logic.

07 Hours

UNIT - 6

Expert Systems: Structure and uses, Representing and using domain knowledge, Expert System Shells. Pattern recognition Learning classification patterns, recognizing and understanding speech. Introduction to knowledge Acquisition, Types of Learning.

07 Hours

UNIT - 7

Typical Expert Systems: MYCIN, Variants of MYCIN, PROSPECTOR, DENDRAL, PUFF, ETC.

06 Hours

UNIT - 8

Introduction To Machine Learning: Perceptrons, Checker Playing Examples, Learning Automata, Genetic Algorithms, Intelligent Editors.

06 Hours

TEXT BOOKS:

1. **Artificial Intelligence,** Elaine Rich & Kevin Knight, 3rd Ed., M/H 1983.
2. **Introduction to AI & ES,** Dan W. Patterson, Prentice Hall of India, 1999.

REFERENCE BOOKS:

1. **Principles of Artificial Intelligence**, Springer Verlag, Berlin, 1981.
2. **Artificial Intelligence in business, Science & Industry**, Wendy B. Ranch
3. **A guide to expert systems,** Waterman, D.A., Addison – Wesley inc. 1986
4. **Building expert systems,** Hayes, Roth, Waterman, D.A. Addison – Wesley, 1983

DESIGN OF EXPERIMENTS

Sub Code	**: 10ME 847**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT - 1

Introduction: Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments.

05 Hours

UNIT - 2

Basic Statistical Concepts: Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples.

07 Hours

UNIT - 3

Experimental Design: Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples.

07 Hours

UNIT - 4

Analysis And Interpretation Methods: Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples.

07 Hours

PART - B

UNIT - 5

Quality By Experimental Design: Quality, Western and Taguchi's quality philosophy, elements of cost, Noise factors causes of variation. Quadratic loss function & variations of quadratic loss function. Robust Design: Steps in Robust Design: Parameter design and Tolerance Design. Reliability Improvement through experiments, Illustration through Numerical examples.

06 Hours

UNIT - 6

Experiment Design Using Taguchi's Orthogonal Arrays: Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples.

08 Hours

UNIT - 7

Signal To Noise Ratio: Evaluation of sensitivity to noise. Signal to Noise ratios for static problems: Smaller-the-better type, Nominal-the –better-type, Larger-the-better type. Signal to Noise ratios for Dynamic problems. Illustration through Numerical examples.

06 Hours

UNIT - 8

Parameter And Tolerance Design: Parameter and tolerance design concepts, Taguchi's inner and outer arrays, parameter design strategy, tolerance design strategy. Illustration through Numerical examples.

06 Hours

TEXT BOOKS:

1. **Design and Analysis of Experiments,** Douglas C. Montgomery, 5th Edition Wiley India Pvt. Ltd. 2007
2. **Quality Engineering using Robust Design,** Madhav S. Phadke, Prentice Hall PTR, Englewood Cliffs, New Jersy 07632, 1989.

REFERENCE BOOK:

1. **Quality by Experimental Design,** Thomas B. Barker, Marcel Dekker, Inc ASQC Quality Press.1985.
2. **Experiments Planning, analysis, and parameter Design optimization,** C.F. Jeff Wu Michael Hamada, John Wiley Editions. 2002.
3. **Reliability Improvement by Experiments,** W.L. Condra, Marcel Dekker, Inc ASQC Quality Press.1985.
4. **Taguchi Techniques for Quality Engineering,** Phillip J. Ross, 2nd Edn. McGraw Hill International Editions, 1996.

DESIGN FOR MANUFACTURING AND ASSEMBLY

Sub Code	**: 10ME 848**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT-1

Tolerances, Limits & Fits: General Tolerances, Tolerance grades, Limits fundamental deviation, Fits, Tolerance Accumulation cumulative effect of tolerances in assembly. Relationship between attainable tolerance grades and different machining processes.

06 Hours

UNIT-2

Geometric Tolerances: Geometrical characteristics and symbols. Definition and Measurement of circularity, cylindricity, flatness and runout. True position tolerance.

Surface Roughness : Terminology, Terms used for surface roughness, measurement of surface roughness. Surface roughness values obtained from various machining processes.

08 Hours

UNIT-3

Cumulative Effect Of Tolerances: sure fit law and truncated normal law. Selective assembly and interchangeable part manufacture, Control of axial play by introducing secondary machining processes and by adding laminated shims.

06 Hours

UNIT-4

Statistical Quality Control: Frequency distribution, standard deviation concept of skewness & Kurtosh variance, Process capability, Indices C_p and C_{pk} control charts.

06 Hours

PART - B

UNIT-5

Component Design From Casting Considerations: Pattern, Mould, Parting line, cored holes and machined holes, Design for reducting/eliminating sand cores.

06 Hours

UNIT-6

Component Design From Machining Consideration: Design considerations for turning, drilling, tapping, milling and grinding operations, provisions for clamping, Reduction in machining area, simplification by separation and amalgamation, Use of productive machines.

06 Hours

UNIT-7

Design Considerations: Major Design Phases. Design for Manufacturability consideration. Influence of Fabrication properties (Machinability, Castability, Weldability, Polymer processing).

07 Hours

UNIT-8

Selection Of Materials In Design: Properties of Materials used in design. Material selection process – cost per unit property, weighted properties and limits on properties methods.

07 Hours

TEXT BOOKS:

1. **Design for Manufacture,** Harry Peck,Pitman Publications,1983.
2. **Engineering Metrology,** R.K. Jain Khanna Publishers,2000.

REFERENCE BOOKS:

1. **ASM Handbook,vol.20.** Material selection & Design.

2. **Design for Manufacturability Handbook,** Jamesh G. Baralla, Editor, Mcgraw Hill 1998.
3. **Product Design for Manufacture and Assembly,** Geoffery Boothroyed et al 'Mercel Dekker Inc. New York.
4. **Engineering Design: A Materials and Processing Approach,** Geaorge. E. Dieter, Mcgraw Hill, 1991.