

ENGINEERING MATHEMATICS – III

CODE: 10 MAT 31  
Hrs/Week: 04  
Total Hrs: 52  
Marks:100

IA Marks: 25  
Exam Hrs: 03  
Exam

**PART-A**

**Unit-I: FOURIER SERIES**

Convergence and divergence of infinite series of positive terms, definition and illustrative examples\*  
Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period  $2\pi$  and arbitrary period, half range Fourier series. Complex form of Fourier Series.  
Practical harmonic analysis. **[7 hours]**

**Unit-II: FOURIER TRANSFORMS**

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms  
**[6 hours]**

**Unit-III: APPLICATIONS OF PDE**

Various possible solutions of one dimensional wave and heat equations, two dimensional Laplace's equation by the method of separation of variables, Solution of all these equations with specified boundary conditions.  
D'Alembert's solution of one dimensional wave equation.  
**[6 hours]**

**Unit-IV: CURVE FITTING AND OPTIMIZATION**

Curve fitting by the method of least squares- Fitting of curves of the form

$$y = ax + b, \quad y = ax^2 + bx + c, \quad y = ae^{bx}, \quad y = ax^b$$

Optimization: Linear programming, mathematical formulation of linear programming problem (LPP), Graphical method and simplex method.

**[7 hours]**

## **PART-B**

### **Unit-V: NUMERICAL METHODS - 1**

Numerical Solution of algebraic and transcendental equations: Regula-falsi method, Newton - Raphson method. Iterative methods of solution of a system of equations: Gauss-seidel and Relaxation methods. Largest eigen value and the corresponding eigen vector by Rayleigh's power method.

**[6 hours]**

### **Unit-VI: NUMERICAL METHODS – 2**

Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences - Newton's divided difference formula, Lagrange's interpolation formula and inverse interpolation formula.

Numerical integration: Simpson's one-third, three-eighth and Weddle's rules (All formulae/rules without proof)

**[7 hours]**

### **Unit-VII: NUMERICAL METHODS – 3**

Numerical solutions of PDE – finite difference approximation to derivatives, Numerical solution of two dimensional Laplace's equation, one dimensional heat and wave equations [7 hours]

**Unit-VIII: DIFFERENCE EQUATIONS AND Z-TRANSFORMS**

Difference equations: Basic definition; Z-transforms – definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems. Inverse Z-transform. Application of Z-transforms to solve difference equations.

[6 hours]

**Note: \* In the case of illustrative examples, questions are not to be set.**

**Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

**Reference Book:**

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd. Publishers

**MATERIAL SCIENCE AND METALLURGY**

<b>Subject Code</b>	<b>: 10ME32A /42A</b>	<b>IA Marks</b>	<b>: 25</b>
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## **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, Ficks 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's and MMC's advantages and application of composites.

**07 Hours**

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

1. **An Introduction to Metallurgy; Alan Cottrell**, Universities 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, 5<sup>th</sup> Edition, 2001.
7. **The Science and Engineering of Materials**, Donald R. Askland and Pradeep.P. Phule, Cengage Learning, 4<sup>th</sup> Ed., 2003.

## MECHANICAL MEASUREMENTS AND METROLOGY

<b>Subject Code</b>	<b>: 10ME32B /42B</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
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### 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, hysteresis, 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, 6<sup>th</sup> 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**, Alstutko, Jerry. D. Faulk, Cengage Asia Pvt. Ltd. 2002.
4. **Measurement Systems Applications and Design**, Ernest O. Doebelin, 5<sup>th</sup> Ed., McGraw Hill Book Co.
5. **Metrology & Measurement**, Anand K. Bewoor & Vinay A. Kulkarni, Tata McGraw Hill Pvt. Ltd., New-Delhi

**BASIC THERMODYNAMICS**

(Common to ME/IP/AU/IM/MA)

<b>Subject Code</b>	<b>: 10ME33</b>	<b>IA Marks</b>	<b>: 25</b>
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**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 ;rocesses; 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:** Mechanics, definition 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 experiments, 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 at constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as film 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 thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.

**07 Hours**

### **PART-B**

#### **UNIT - 5**

**Entropy:** Clausius 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, Clausius Clayperon's equation. Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and particular gas constants, 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 processes. Real Gases: Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart

**06 Hours**

#### Data Handbooks :

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

#### TEXT BOOKS:

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

#### REFERENCE BOOKS:

1. **Thermodynamics**, An Engineering Approach, Yunus A.Cengel 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 Thermodynamics**, Y.V.C.Rao, Wiley Eastern, 1993,
5. **B.K Venkanna, Swati B. Wadavadagi "Basic Thermodynamics**, PHI, New Delhi, 2010

### MECHANICS OF MATERIALS

<b>Subject Code</b>	<b>: 10ME34</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
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## 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, Castigliano's theorem, Energy methods.

**Thick and Thin Cylinder** Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lamé'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 Johnston, 5<sup>th</sup> 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, Edition, 1998.
5. "**Strength of Materials**", W.A. Nash, 5th Ed., Schaum's Outline Series, Fourth Edition-2007.

**MANUFACTURING PROCESS – I  
(FUNDAMENTALS OF FOUNDRY & WELDING)**

<b>Subject Code</b>	<b>: 10ME35</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
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**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<sub>2</sub> 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, 5<sup>th</sup> Revised Edition 2009.
2. “**Manufacturing & Technology: Foundry Forming and Welding**”, P.N.Rao, 3<sup>rd</sup> Ed., Tata McGraw Hill, 2003.

#### **REFERENCE BOOKS:**

1. “**Process and Materials of Manufacturing**”, Roy A Lindberg, 4<sup>th</sup> Ed. Pearson Edu. 2006.
2. “**Manufacturing Technology**”, Serope Kalpakjian, Steuen. R. Sechmid, Pearson Education Asia, 5<sup>th</sup> Ed. 2006.

### **COMPUTER AIDED MACHINE DRAWING**

**Subject Code** :10ME36A/10ME46A **IA Marks** : 25

<b>Hours/Week</b>	<b>: 04(1 Hrs. Theory &amp; 3 Hrs Practical)</b>	<b>Exam Hours</b>	<b>: 03</b>
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**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.

<b>i.e.</b>	<b>PART-A 1 x 20 = 20 Marks</b>
	<b>PART-B 1 x 20 = 20 Marks</b>
	<b>PART-C 1 x 60 = 60 Marks</b>
	<hr/>
<b>Total</b>	<b>= 100 Marks</b>

### FLUID MECHANICS

<b>Subject Code</b>	<b>: 10ME36B / 46B</b>	<b>IA Marks</b>	<b>: 25</b>
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### 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 (Cartesian 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  $\pi$  theorem, dimensionless numbers, similitude, types of similitudes.

**07 Hours**

**UNIT-6**

**Flow through pipes :** Minor losses through pipes. Darcy'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 :** Reynold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseuille'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 number, Mach cone, propagation of pressure waves in a compressible fluid.

**07 Hours**

**TEXT BOOKS:**

1. **Fluid Mechanics**, Oijush.K.Kundu, IRAM COCHEN, ELSEVIER, 3<sup>rd</sup> 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, 2<sup>nd</sup> Ed., Tata McGraw Hill, 2006.

3. **Fluid Mechanics**, John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5<sup>th</sup> 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**

<b>Subject Code</b>	<b>: 10MEL37A / 47A</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hours</b>	<b>: 48</b>	<b>Exam Marks</b>	<b>: 50</b>

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#### **PART – A**

1. Preparation of specimen for Metallographic 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:**

<b>ONE question from part -A:</b>	<b>20 Marks</b>
<b>ONE question from part -B:</b>	<b>20 Marks</b>
<b>Viva -Voice:</b>	<b>10 Marks</b>

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**Total : 50 Marks**

**MECHANICAL MEASUREMENTS AND METROLOGY  
LABORATORY**

<b>Subject Code</b>	<b>: 10MEL37B / 47B</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hours</b>	<b>: 48</b>	<b>Exam Marks</b>	<b>: 50</b>

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**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:**

<b>ONE question from part -A:</b>	<b>20 Marks</b>
<b>ONE question from part -B:</b>	<b>20 Marks</b>
<b>Viva -Voice:</b>	<b>10 Marks</b>

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**Total : 50 Marks**

**FOUNDRY AND FORGING LABORATORY**

<b>Subject Code</b>	<b>: 10MEL38A / 48A</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hours</b>	<b>: 48</b>	<b>Exam Marks</b>	<b>: 50</b>

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**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 Fineness 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

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**Viva-Voce : 10 marks.**

**Total : 50 Marks.**

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**MACHINE SHOP**

<b>Subject Code</b>	<b>: 10MEL38B / 48B</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hours</b>	<b>: 48</b>	<b>Exam Marks</b>	<b>: 50</b>

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**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**

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**Total : 50 Marks**

**ENGINEERING MATHEMATICS – IV**

**CODE: 10 MAT 41  
Hrs/Week: 04  
Total Hrs: 52  
Marks:100**

**IA Marks: 25  
Exam Hrs: 03  
Exam**

**PART-A**

**Unit-I: NUMERICAL METHODS - 1**

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, Taylor's series method, modified Euler's method, Runge-kutta method of fourth-order. Milne's and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

**[6 hours]**

**Unit-II: NUMERICAL METHODS – 2**

Numerical solution of simultaneous first order ordinary differential equations: Picard's method, Runge-Kutta method of fourth-order.

Numerical solution of second order ordinary differential equations: Picard's method, Runge-Kutta method and Milne's method.

**[6 hours]**

**Unit-III: Complex variables – 1**

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions.

Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.

[7 hours]

#### **Unit-IV: Complex variables – 2**

Conformal Transformations: Bilinear Transformations. Discussion of Transformations:  $w = z^2$ ,  $w = e^z$ ,  $w = z + (a^2 / z)$ . Complex line integrals- Cauchy's theorem and Cauchy's integral formula.

[7 hours]

### **PART-B**

#### **Unit-V: SPECIAL FUNCTIONS**

Solution of Laplace equation in cylindrical and spherical systems leading Bessel's and Legendre's differential equations, Series solution of Bessel's differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

[7 hours]

#### **Unit-VI: PROBABILITY THEORY - 1**

Probability of an event, empirical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye's theorem.

[6 hours]

### **Unit-VII: PROBABILITY THEORY- 2**

Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions.

**[7 hours]**

### **Unit-VIII: SAMPLING THEORY**

Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student's t-distribution. Chi -Square distribution as a test of goodness of fit

**[6 hours]**

### **Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

### **Reference Book:**

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

### APPLIED THERMODYNAMICS

<b>Subject Code</b>	<b>: 10ME43</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hours</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

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### 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**

**Psychometry:** Atmospheric air and psychometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidities and the relation between the two enthalpy and adiabatic saturation temperature. Construction and use of psychometric 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. **Thermodynamic data hand book**, B.T. Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroia, Birla Pub. Pvt. Ltd., Delhi, 2008

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

1. **Thermodynamics , An engineering approach**, Yunus, A. Cengel and Michael A.Boies, 6<sup>th</sup> 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**

<b>Subject Code</b>	<b>: 10ME44</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hours</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

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**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)

<b>Subject Code</b>	<b>: 10ME45</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hours/Week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hours</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

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### PART – A

#### UNIT - 1

**Theory of Metal Cutting:** Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation, Types of Chips. Merchant's 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 Planing Machines:** Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Planing Machine, Driving mechanisms of lathe, shaping and planing machines, Different operations on lathe, shaping machine and planing 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-constructural 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.

### **V SEMESTER MANAGEMENT & ENTREPRENEURSHIP**

Subject Code	: 10AL 51	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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**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 – Modern 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/GATT 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).
4. **Management & Enterpreneruship**-N V R Naidu, IK Internatioal, 2008

**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 – 17<sup>th</sup> Edition, 2003.

**ENGINEERING ECONOMY**

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

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**PART - A**

**UNIT - 1**

**INTRODUCTION:** Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy

**6 Hours**

**UNIT - 2**

**INTEREST AND INTEREST FACTORS:** Interest rate, simple interest Compound interest, Cash- flow diagrams, Exercises and Discussion.

**6 Hours**

**UNIT - 3**

**PRESENT WORTH COMPARISON:** 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.

**7 Hours**

**UNIT - 4**

**EQUIVALENT ANNUAL WORTH COMPARISONS:** Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparison Consideration of asset life, Comparison of assets with equal and unequal lives, Use of sinking fund method, Annuity contract for guaranteed income, Exercises, Problems.

**7 Hours**

**PART - B**

**UNIT - 5**

**RATE OF RETURN CALCULATIONS:** Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts, replacement models.

**4 Hours**

**STRUCTURAL ANALYSIS OF ALTERNATIVES:** Identifying and Defining alternatives, IRR analysis of mutually exclusive alternatives, Capital Budget view point, Ranking criteria.

**3 Hours**

**UNIT - 6**

**DEPRECIATION:** Causes of Depreciation, Basic methods of computing depreciation charges

**3 Hours**

**ESTIMATING & COSTING:** Components of costs such as Direct Material Cost, Direct Labour Cost, Fixed, Over – Heads, Factory Costs, Administrative – Over Heads, First Cost, Marginal Cost, Selling price, Estimation for simple components

**4 Hours**

**UNIT - 7**

**REPLACEMENT ANALYSIS:** Introduction, reasons for replacement, Individual Replacement of machinery or equipment with/without value of money, Group Replacement Policies, Problems.

**6 Hours**

**UNIT - 8**

**EFFECTS OF INFLATION:** Causes, consequences and control of inflation. After tax actual cash flow comparisons, Lease/ Buy decisions

**2 Hours**

**BREAK-EVEN ANALYSIS**

Basic Concepts Linear & non-linear break even analysis.

**4 Hours**

**TEXT BOOKS:**

1. **Engineering economics** - RIGGS J.L. - McGraw Hill - 2002.
2. **Engineering economy** - PAUL DEGARMO - Macmillan Pub Co. - 2001.
3. **Engineering Economy** - Naidu, Babu and Rajendra – New Age International Pvt. Ltd. – 2006.

**REFERENCE BOOKS:**

1. **Industrial Engineering and Management** - OP KHANNA - Dhanpat Rai & Sons – 2000.
2. **Financial Management** - I M PANDAY - Vikas Publishing House - 2002.
3. **Engineering economy** - THUESENH.G. – PHI – 2002.

**WORK STUDY AND ERGONOMICS**

Subject Code	: 10IP /IM 53	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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## PART – A

### UNIT - 1

**PRODUCTIVITY:** Definition of productivity, individual enterprises, task of management Productivity of materials, land, building, machine and power. Measurement of productivity, factors affecting the productivity, productivity improvement programmes, wages and incentives (simple numerical problems)

**7 Hours**

### UNIT - 2

**WORK STUDY:** Definition, objective and scope of work study. Human factor in work study. Work study and management, work study and supervision, work study and worker.

**6 Hours**

### UNIT - 3

**INTRODUCTION TO METHOD STUDY:** Definition, objective and scope of method study, activity recording and exam aids. Charts to record movements in shop operation – process charts, flow diagram, flow process charts, travel chart and multiple activity charts. (With simple problems)

**7 Hours**

### UNIT - 4

**MICRO AND MEMO MOTION STUDY:** Charts to record movements at work place – principles of motion economy, Therbligs and classification of movements, Two Handed process chart, SIMO chart, and micro motion study. Development, definition and installation of the improved method, brief concept about synthetic motion studies.

**6 Hours**

## PART - B

### UNIT - 5

**INTRODUCTION TO WORK MEASUREMENT:** Definition, objective and benefit of work measurement. Work measurement techniques:

**WORK SAMPLING,** need, confidence levels, sample size determinations, random observation, conducting study with the simple problems.

**6 Hours**

### UNIT - 6

**STOP WATCH TIME STUDY:** Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating & standard Rating, standard performance, scale of rating, factors affecting rate of working, allowances and standard time determination.

**PREDETERMINED MOTION TIME STUDY (PMTS)**

METHOD TIME MEASUREMENT (MTM)

**7 Hours**

**UNIT - 7**

**ERGONOMICS:** Introduction, Areas of study under Ergonomics, System approach to Ergonomics model, Man-Machine System. Components of Man-Machine System and Their functions – Work capabilities of Industrial Worker, Study of Development of Stress in Human body and their consequences. Computer based ergonomics

**6 Hours**

**UNIT - 8**

**DESIGN OF MAN-MACHINE SYSTEM:** Fatigue in industrial workers. Quantitative qualitative representation and alphanumeric displays. Controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines. Design of work places, influence of climate on human efficiency. Influence of noise, vibration and light.

**7 Hours**

**TEXT BOOKS:**

1. **Introduction to work study, ILO** - III Revised Edition, 1981
2. **Motion and Time study** - Ralph M Barnes - John Wiley - 8<sup>th</sup> Edition, 1985.
3. **Motion and Time study** - Marvin E. Mundel – PHI -1<sup>st</sup> edition.
4. **Work Study and Ergonomics** - S Dalela and Sourabh, – Chand Publishers - 3<sup>rd</sup> edition.

**REFERENCES BOOKS:**

1. **Human Factors in Engineering Design** - S Sanders and E J McCormick - Mc Graw Hill - 6<sup>th</sup> Edition.
2. **Industrial Engineering Hand book** - Maynard.
3. **Engineered work Measurement** – Wledon - ELBS - 1991.

**CAD/CAM**

Subject Code	: 10IP /IM 54	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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## **PART - A**

### **UNIT - 1**

**INTRODUCTION:** CAD/CAM, Product cycle & CAD/CAM, Design process, Application of Computers for Design, Traditional Production Planning & Control, Computerized Integrated Production Management System, Advantages & Disadvantages of CAD & CAM.

**FUNDAMENTALS OF CAD:** Comparison of general design process and CAD process, Concept of manufacturing data base, general consideration of Hardware for a typical CAD system. **7 Hours**

### **UNIT - 2**

**COMPUTER GRAPHICS SOFTWARE & DATA BASE:** Introduction, Software Configuration of a Graphics System, Functions of a Graphics Package, Constructing the Geometry, Transformations, Data Base Structure & Content, Wire-Frame versus Solid Modeling, Introduction to exchange of modeling data-Basic features of IGES, STEP, DXF, DMIS. **7 Hours**

### **UNIT - 3**

**INTRODUCTION TO FINITE ELEMENT ANALYSIS:** Introduction, Basic Concepts, Discretization, Element types, Nodes & degrees of freedom, Mesh generation, Constraints, Loads, Preprocessing, Application to static analysis. **6 Hours**

### **UNIT - 4**

**NC, CNC, DNC TECHNOLOGIES:** NC, CNC, DNC, Modes, NC Elements, Advantages and Limitations of NC, CNC. Functions of computers in DNC.

**CNC MACHINE TOOLS:** CNC tooling, Turning tool geometry, Milling tooling system, Tool presetting, ATC, Work holding, Overview of different CNC machining centers, CNC Turning centers, High speed machine tools. **7 Hours**

## **PART - B**

### **UNIT - 5**

**CNC PROGRAMMING:** Part program fundamentals, Steps involved in development of a part program, Manual part programming, Milling & Turning Center Programming **7 Hours**

### **UNIT - 6**

**APT PROGRAMMING:** APT Programming in Drilling, Milling & Turning  
**6 Hours**

**UNIT - 7**

**INTRODUCTION TO ROBOTICS:** Introduction, Robot configuration, Robot motions, End effectors, Work cell, Control & Interlock, Robot Sensor, Robot applications.  
**6 Hours**

**UNIT - 8**

**PROGRAMMING THE ROBOTS :** Robot-Programming Languages, Introduction to different languages and writing the programming for palletising operation  
**6 Hours**

**TEXT BOOKS:**

1. **CAD/CAM** - Mikell P. Groover and Emory W. Zimmers Jr - Pearson Education Inc - 2003.
2. **CAD/CAM Principles and Applications** - P.N. Rao – TMH, New Delhi - 2002.

**REFERENCE BOOKS:**

1. **Principles of Interactive Computer Graphics** - Newman and Sproull – Tata McGraw Hill - 1995.
2. **CAD/CAM** - Ibrahim Zeid – Tata McGraw Hill - 1999.
3. **Computer Aided Manufacturing** - P. N. Rao, N. K. Tewari and T. K. Kundra – Tata McGraw Hill - 1999.

**DESIGN OF MACHINE ELEMENTS**

Subject Code	: 10IP /IM 55	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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## PART - A

### UNIT - 1

**DESIGN FOR STATIC STRENGTH:** Design considerations; Codes and Standards, static loads and factor of safety. Theories of failure: Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion energy theory. Failure of Brittle and Ductile materials. Stress concentration. Determination of stress concentration factor. **7 Hours**

### UNIT - 2

**DESIGN FOR FATIGUE STRENGTH:** S – N Diagram, low cycle and High cycle fatigue. Endurance limit. Modifying factors: Load, Size and Surface finish effects. Fatigue stress concentration factor. Fluctuating stresses. Goodman and Soderberg Relationship. Stresses due combined loading, Cumulative fatigue damage. **6 Hours**

### UNIT - 3

**KEYS, COUPLINGS, COTTER AND KNUCKLE JOINTS:** Design of Keys, Design of rigid flange coupling, Bush and Pin type Flexible Coupling, Design of Cotter and Knuckle joints. **6 Hours**

### UNIT - 4

**DESIGN OF SHAFTS:** Design of shafts subjected to torsion, bending moment and combined torsion moment and axial loading. ASME and BIS Codes for design of transmission shafting. Design for strength and rigidity. Shafts under fluctuating loads and combined loads. **7 Hours**

## Part B

### UNIT - 5

**DESIGN OF GEARS:** Introduction to Spur, Helical and Bevel Gears. Design of Spur gear, Lewis equation, form factor, stresses in gear tooth, Dynamic load and wear load. **6 Hours**

### UNIT - 6

**RIVETED JOINTS AND WELDED JOINTS:** Types of riveted joints, failures of riveted joints, Boiler joint, Efficiency.

Types of welded joints, Strength of butt and fillet welds, Eccentrically loaded welds. **7 Hours**

### UNIT - 7

**DESIGN OF SPRINGS:** Types of springs, Stresses in Coil springs of circular and non-circular cross-sections. Tension and compression springs. Stresses in Leaf springs. **6 Hours**

### UNIT - 8

**LUBRICATION AND BEARINGS:** Mechanism of lubrication, Viscosity, Bearing Modulus, Coefficient of friction, minimum oil film thickness. Heat generated and Heat dissipated.

Examples of journal bearing and thrust bearing design.

**BALL AND ROLLER BEARINGS:** Bearing life, Equivalent bearing load, Selection of Deep groove ball bearings. **7 Hours**

**TEXT BOOKS:**

1. **Mechanical Engineering Design** - Joseph Edward Shigley – Tata McGraw Hill, New Delhi - 1986.
2. **Machine Design** - VL. Maleev and Hartman – CBS Publishers and Distributors, Delhi - 1983.
3. **Design of Machine Elements** - V. B. Bahandari – Tata McGraw Hill, New Delhi - 2000.

**REFERENCE BOOKS:**

1. **Machine Design** - Robert. L. Norton – Pearson Education Asia, New Delhi - 2001.
2. **Theory and Problems of Machine Design** - Hall, Holowinko, Laughlin Schaums - Outline Series - 2002.
3. **Elements of Machine Design** - N. C. Pandey and C. S. Shah – Chorotar Publishing house – 2002.

**V SEMESTER**

**HYDRAULICS AND PNEUMATICS**

Subject Code	:	10 IP56	IA Marks	:	25
No. of Lecture Hours./ Week	:	04	Exam Hours	:	03

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**PART - A**

**UNIT - 1**

**INTRODUCTION TO HYDRAULIC SYSTEM:** Hydraulic oils – Desirable properties, Viscosity index, General type of fluids, Reservoir system, Filters and strainer. Pascal's Law and its applications, Application of Continuity equation, Structure of a typical Hydraulic circuit and the components of it. (Numerical Treatment). **6 Hours**

**UNIT - 2**

**PUMPS:** Pumping theory, Pump Classification, Gear Pumps, Vane Pumps- Simple and Balanced, Piston Pumps, Pump performance, Pump selection (Numerical Treatment).

**7 Hours**

**UNIT - 3**

**HYDRAULIC ACTUATORS & MOTORS:** Linear Hydraulic Actuators (Cylinders), Mechanics of Hydraulic Cylinder Loading, Cylinder cushioning, Hydraulic Rotary Actuators, Gear Motors, Vane Motors, Piston Motors, Hydrostatic Transmission – open and close circuit. (Numerical Treatment).

**7 Hours**

**UNIT - 4**

**CONTROL COMPONENTS IN HYDRAULIC SYSTEMS:** Directional Control Valves (DCV), Constructional features, 2/2, 3/2, 4/2, 4/3 DCV, Center configuration in 4/3 DCV- Closed, Open, Tandem, Regenerative and Floating, Actuation of DCVs, Check valve, Pilot check valve, Pressure control valves – direct and pilot operated types, Pressure reducing valve, Flow control valves, Pressure compensated flow control valve. Throttle check valve.

**7 Hours**

**PART - B**

**UNIT - 5**

**STUDY OF DIFFERENT HYDRAULIC CIRCUITS :** Control of single and Double acting Hydraulic cylinder, Regenerative circuit, Counter balance Valve application, Hydraulic Cylinder sequencing Circuits, Cylinder Synchronizing Circuits, Speed Control of Hydraulic Cylinder – Meter in & Meter out, speed control of Hydraulics Motors, Accumulators and their applications in Auxiliary and Emergency power source. **6 Hours**

**UNIT - 6**

**INTRODUCTION TO PNEUMATIC CONTROL:** Choice of working medium, Characteristics of compressed air, Structure of Pneumatic control system, Production of compressed air, Preparation of compressed air – Driers, Filters, Regulators, Lubricators. **6 Hours**

### UNIT - 7

**PNEUMATIC ACTUATORS & VALVES:** Linear Cylinder – Types, Conventional type of cylinder – working, End position cushioning, Directional control valve-3/2,4/2,&5/2, Memory valve, Shuttle valve, Quick exhaust valve, Twin pressure valve, Direct and indirect actuation of pneumatic cylinder. **7 Hours**

### UNIT -8

**PNEUMATIC LOGIC CIRCUITS:** Use of Logic functions – OR, AND, NOR, NAND, NOT functions in pneumatic applications, Practical examples involving the use of logic functions, Pressure dependent controls and Travel dependent controls. **6 Hours**

### TEXT BOOKS:

1. **Fluid Power with applications** - Anthony Esposito – Pearson Education - Fifth edition, Inc 2000.
2. **Oil Hydraulic Systems – Principles and Maintenance** - S. R. Majumdar – Tata McGraw Hill Publishing Company Ltd. - 2001.
3. **Pneumatic Systems** - S. R Majumdar – Tata McGraw Hill Publishing Co. – 1995.

### REFERENCE BOOKS:

1. **Pneumatic Basic Level TP 101** - Peter Croser & Frank Ebel, Festo – Didactic publication - 1999.
2. **Pneumatic Control for Industrial Automation** - Peter Rohner & Gordon Smith – John Wiley Sons publication – 1989.
3. **Power Hydraulics** - Michael J Pinches & John G Ashby – Prentice Hall – 1989.

### MECHANICAL AND FLUID POWER LAB

Subject Code	:	10IPL 57	IA Marks	:	25
No. of Lab Hours./ Week	:	03	Exam Hours	:	03
Total No. of Lab Hours.	:	42	Exam Marks	:	50

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**PART – A**

**FLUID POWER LAB**

1. a) Study of components of Hydraulic circuit.  
b) Study of symbols for components in hydraulic circuits.
2. Testing of Pump.
3. Testing of Flow Control Valve.
4. Speed control of Piston in Forward and Return stroke with Meter in Meter out circuit.
5. Study of Regenerative circuit and study of Bleed of circuit.
6. Study of Variation of Flow with pressure and with throttle.
7. Building of Circuits using different kinds of Valves.

**PART - B**

**MECHANICAL ENGINEERING LAB**

(At least Four experiments)

1. Determination of viscosity of lubricating oil using Redwoods and Saybolts – Viscometers.
2. Flash and Fire point of given oil
3. Performance Tests on Four stroke Petrol and Diesel Engines, Calculations of IP, BP, thermal efficiencies, SFC, FP and heat balance sheet.
4. Multi cylinder petrol / diesel engine (Morse test).
5. Performance test on Centrifugal or Reciprocating pumps.
6. Study of flow through pipes for fluid transport.

Note: A minimum of 12 exercisers are to be conducted

**WORK STUDY AND ERGONOMICS LAB**

Subject Code	:	10IPL/IML 58	IA Marks	:	25
No. of Lab Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lab Hrs.	:	42	Exam Marks	:	50

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## **PART - A METHOD STUDY**

Recording Techniques: Preparing the following charts and diagrams  
(Minimum 3 Charts)

1. Outline process chart, Multiple Activity Chart
2. Flow process chart and Flow diagram, String diagram
3. Experiments on the Application of principle of motion economy  
Two handed process chart
4. SIMO chart
5. Exercises on conducting method study for assembling simple components and office work.
6. Development of Layout plans using SLP technique
7. Experiments on Line balancing. (demo only)

## **PART - B WORK MEASUREMENT**

1. Rating practice using: walking simulator, pin board assembly, dealing a deck of cards
2. and marble collection activity
3. Determining the standard time for simple operations using stopwatch time study
4. Exercises on estimating standard time using PMTS.
5. Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
6. Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
7. Effect of Noise, Light, Heat on human efficiency in work environments.

Note: A minimum of 12 exercisers are to be conducted

### **REFERENCE BOOKS:**

1. **ILO Introduction to work study** - III Revised Edition, 1981.
2. **Motion and Time study** - Ralph M Barnes , John Wiley - 8<sup>th</sup> Edition, 1985.
3. **Engineered work Measurement** – Wledon - ELBS - 1991.
4. **Motion and Time study** - Marvin E. Mundel – PHI - 1<sup>st</sup> edition.

**VI SEMESTER  
MATERIALS MANAGEMENT**

Subject Code	: 10IP /IM 61	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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**PART - A**

**UNIT - 1**

**INTRODUCTION:** Dynamics of Materials Management - Materials Management at Micro-level, Materials Management at Macro-level, Inventories of Materials, Total Concept-Definition - A Brief History of Development: An Overview.

**SYSTEMS APPROACH TO MATERIALS MANAGEMENT:** Systems Approach - The Process of Management and the Materials Function, Interfaces, An Overview of the Systems Concept, Benefits of the Integrated Systems Approach.

**6 Hours**

**UNIT - 2**

**FORECASTING** Objectives and the Materials Organization: Systems Design, Integral Control of the Flow of Materials, Forecasting and Planning, Forecasting Methods, Objectives of Materials Management - Organization of Materials Management, Environmental Change, Functional Organization Model for Materials Management.

**MATERIALS PLANNING:** Making the Materials Plan Work, The Materials Cycle and Flow Control System, Materials Budget.

**6 Hours**

**UNIT - 3**

**PURCHASING:** Purchasing Principles, Procedures and Practices, Fundamental Objectives of Purchasing - Scope, Responsibility and Limitations, Sources of Supply and Supplier Selection, Purchasing Policy and Procedures - Purchase Budgets and Statistics.

**PURCHASING IN MATERIALS MANAGEMENT SYSTEM**

**CONCEPT:** Price Determination, Price Forecasting, Price-Cost Analysis, The Learning Curve, Negotiation, Reciprocity, Cost-Plus Contracts, Hedging, Forward Buying, Buying Ethics, Principles and Standards of Purchasing, Make-or-Buy, Information, Documentation and Purchasing Library, Legal Aspects of Purchasing, Law of Agency, Law of Contract, Legal Status of the Buyer, Warranties and Conditions, Right of Inspection,

Right of Rejection, Vendor-Vendee Relations, Vendor Development, Vendor Rating. **8 Hours**

**UNIT- 4**

**PURCHASING AND PROCUREMENT** Activities under Materials Management: Supplier Quality Assurance Programme, Buyer-Supplier Relationship.

**INCOMING MATERIAL QUALITY CONTROL:** Significance of Inspection, Purchase Inspection, Sampling Inspection, Sampling Technique, Different Types of Population, Different Types of Sampling, Risks of Sampling. SQC in Operation: A Work-site Problem Study. **6 Hours**

**PART - B**

**UNIT - 5**

**PURCHASING CAPITAL** Equipment, Plant and Machinery: Responsibility and Decision, Purchasing v/s Leasing, International Buying, Import Purchasing, and Governmental Purchasing: Industrial Needs, Import Procedure and Documents, Classification of Stores-Categories of Importers-Import Application, Basis of Licensing, Import Purchasing Procedures, Letter of Credit, Income-Tax Clearance, Customs Tariff-Registration of Licenses at Port. Governmental Purchasing: Policy and Procedures, Tenders, Inspection of Articles.

**6 Hours**

**UNIT-6**

**REGISTRATION** of Firms, Procedure for Registration, Terms of Registration, Removal of the Firms from the List, Blacklisting of Firms, Banning of Firms, Suspension of Firms, Purchases of the Stores by the DGS&D - Surplus Disposals by the DGS&D, Pre-disposal Inspection of Surpluses.

Inventory Management and Control Systems: Definition of Inventories, The Need for Inventory Audits Control, Types of Inventories, Inventory Control, Max-Min System, Inventories and Demand Uncertainty, Determining Safety Stock.

**7 Hours**

**UNIT – 7**

**INVENTORY MODELS:** Deterministic Inventory Models with numerical examples, Q-system or Quantity Control System or Re-order Point System-Effect of Quantity Discounts, P-system or Periodic Review or Periodic Count System or Replenishment System, Optional Replenishment System or "S, s" Policy, ABC Inventory Classification (Selective Inventory Control - SIC). The Need for a Systems Approach, Materials Planning System (MPS) / Materials Requirement Planning (MRP), Basic Tool.

**7 Hours**

## **UNIT - 8**

**STORES MANAGEMENT AND OPERATION:** Storage System, Stores Location and Layout, Development of Storing, Centralization and Decentralization of Stores, Standardization and Variety Reduction, The Systems, Merits and Demerits of Codification.

**MATERIALS MANAGEMENT INFORMATION SYSTEM AND COMPUTER:** MIS - Management and MM, Computer System for MIS and MM, In-process Materials and Management Control.

**6 Hours**

### **Text Book:**

1. **Materials Management** - A.K. Datta - PHI Pvt. Ltd, New Delhi - 2001.
2. **Operations Research** - S.D. Sharma – Kedarnath, Ramnath &Co – 1996.

### **Reference Book:**

1. **Handbook of Materials Management** - P. Gopalakrishnan - PHI Pvt. Ltd, New Delhi - 2002.
2. **Principles of Operations Research Theory and Practice** - Philips, Ravindran and Soleberg – Wiley India Pvt Ltd.

## QUALITY ASSURANCE AND RELIABILITY

Subject Code	: 10IP/IM 62	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION:** Definition of Quality, Quality function, Dimensions of Quality, Quality Engineering terminology, Brief history of quality methodology, Statistical methods for quality improvement, Quality costs – four categories of costs and hidden costs. Brief discussion on sporadic and chronic quality problems. Introduction to Seven QC tools. **6 Hours**

#### UNIT - 2

**STATISTICAL PROCESS CONTROL:** Introduction to statistical process control – chance and assignable causes for variation. Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts. Case Studies on application of SPC. Process capability – Basic definition, standardized formula, relation to product tolerance and six sigma concept of process capability. **6 Hours**

#### UNIT – 3

**PROBABILITY DISTRIBUTION** – Hyper Geometric, Binomial, Poisson and Normal distribution.

**CONTROL CHARTS FOR VARIABLES:** Controls Charts for X Bar and Range (R) , Statistical basis of the charts, Development and use of X bar and R charts, Interpretation of charts. Control charts for X bar and Standard Deviation (S), Development and use of X bar and S chart. Brief discussion on – Pre control X Bar and S control charts with Variable sample size, Control charts for individual measurements, cusum chart, Moving-range charts. **8 Hours**

#### UNIT - 4

**CONTROL CHARTS FOR ATTRIBUTES:** Control chart for fraction non- conforming (defectives), development and operation of control chart, brief discussion on variable sample size.

Control chart for non-conformities (defects) – development and operation of control chart for constant sample size and variable sample size. Choice

between variables and attributes control charts. Guidelines for implementing control charts. **7 Hours**

## **PART - B**

### **UNIT - 5**

**SAMPLING INSPECTION:** Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling. Operating characteristic curves – construction and use. Determination of average outgoing quality, average outgoing quality level, average total inspection, producer risk and consumer risk. **7 Hours**

### **UNIT - 6**

**USE OF PUBLISHED SAMPLING PLANS:** Gauge Repeatability & Reproducibility & Measurement system analysis.

**STATISTICAL THEORY OF TOLERANCES:** Application of statistical theory of tolerances to design tolerances in random assemblies and application in other areas. **6 Hours**

### **UNIT - 7**

**RELIABILITY AND LIFE TESTING:** Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, parallel and series-parallel device configurations, Redundancy and improvement factors evaluation. **6 Hours**

### **UNIT - 8**

**QUALITY ASSURANCE:** Definition and concept of quality assurance, departmental assurance activities. Quality audit concept, audit approach etc. structuring the audit program, planning and performing audit activities, audit reporting, ingredients of a quality program. **6 Hours**

### **TEXT BOOKS:**

1. **Introduction to statistical Quality Control** - D C Montgomery - John Wiley and Sons – 3<sup>rd</sup> Edition.
2. **Quality Planning & Analysis** - J M Juran, Frank M Gryna - Tata McGraw Hill - 3<sup>rd</sup> edition,
3. **Statistical Quality Control** - Grant and Leavenworth - McGraw Hill-6<sup>th</sup> Edition

### **REFERENCE BOOKS:**

1. **The QS9000 Documentation Toolkit** -Janet L Novak and Kathleen C Bosheers - Prentice Hall PTR - 2<sup>nd</sup> Edition
2. **ISO 9000 a Manual for Total Quality Management** - Suresh Dalela and Saurabh - S Chand and Co. -1<sup>st</sup> Edition

3. **Total Quality Management** – NVR Naidu, KM Babu and G. Rajendra  
– New Age International Pvt. Ltd - 2006

**OPERATIONS RESEARCH**

Subject Code	:	10IP/IM 63	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

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**PART - A**

**UNIT – 1**

**INTRODUCTION:** OR Methodology, Definition of OR, Application of OR to Engineering and Managerial Problems, Features of OR models, Limitation of OR, Models of OR.

**LINEAR PROGRAMMING:** Definition, Mathematical formulation,

**6 Hours**

**UNIT-2**

**LINEAR PROGRAMMING** Standard form, solution space, Solution – Feasible, basic feasible, Optimal, Infeasible, Multiple, Optimal, Redundancy, Degeneracy. Graphical Method

**6 Hours**

**UNIT -3**

**LINEAR PROGRAMMING:** Simplex method, variants of simplex algorithm – Artificial basis techniques, Duality, Economic interpretation of Dual, Solution of LPP using duality concept, Dual simplex method.

**7 Hours**

**UNIT - 4**

**TRANSPORTATION PROBLEM:** Formulation of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method) Optimality Methods. Unbalanced transportation problem, Degeneracy in transportation problems, Variants in Transportation Problems, Applications of Transportation problems.

**7 Hours**

**PART - B**

**UNIT - 5**

**ASSIGNMENT PROBLEM:** Formulation of the Assignment problem, unbalanced assignment problem, travelling salesman problem

**6 Hours**

**UNIT - 6**

**QUEUING THEORY:** Queuing system and their characteristics, The M/M/1 Queuing system, Steady state performance analysing of M/M/1 queuing model. M/M/K/ Model

**6 Hours**

#### **UNIT - 7**

**PROJECT MANAGEMENT USING NETWORK ANALYSIS:** Network construction, determination of critical path and duration, CPM Structured approach, Calculations of schedules and floats, Network crashing. PERT- Estimation of project duration and variance. **8 Hours**

#### **UNIT -8**

**GAME THEORY:** Formulations of games, Two person zero sum game, games with and without saddle point, graphical solutions (2x n, mx2 game), dominance property. Solution of game through LPP. **6 Hours**

#### **TEXT BOOKS:**

1. **Introduction to Operation Research** - Taha H A - Prentice Hall of India - 6<sup>th</sup> edition, 1999.
2. **Principles of Operations Research Theory and Practice** - Philips, Ravindran and Soleberg – Wiley India Pvt Ltd.

#### **REFERENCE BOOKS:**

1. **Introduction to Operation Research** -Hiller and Libermann - McGraw Hill - 5<sup>th</sup> edn.
2. **Operations Research** - S.D. Sharma – Kedarnath, Ramnath &Co – 1996.
3. **Operations Research Theory and Application** - J K Sharma - Pearson Education Pvt Ltd - 2<sup>nd</sup> Edn, ISBN-0333-92394-4.

## TOOL ENGINEERING & DESIGN

Subject Code	:	10IP 64	IA Marks	:	25
No. of Lecture Hours./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours.	:	52	Exam Marks	:	100

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### PART - A

#### UNIT - 1

**DESIGN OF SINGLE POINT TOOL:** Tool Signature, Selection of Tool Angles, Design of shank section for single point tool to account for strength and rigidity.

Design of Multi Point Tools - Drill, Reamers **7 Hours**

#### UNIT - 2

**DESIGN** of peripheral Milling cutters, Design of Broach. **6 Hours**

#### UNIT - 3

**LOCATION AND CLAMPING:** General principles of location, 3-2-1 Principle of Location, Principle of Radial location, General study of locating devices. General principles of clamping, Study of various Clamping devices.

**6 Hours**

#### UNIT - 4

**DESIGN OF FIXTURES:** Difference between a Jig and a Fixture, Design of Milling fixture, Study of other fixtures like Lathe fixture, Inspection fixture. Study of different types of Drill jigs.

**7 Hours**

### PART - B

#### UNIT - 5

**DESIGN OF GAUGES:** Types of gauges. Factors to be considered in the design of gauges, Design of Plug gauge, Design of Snap gauge. **6 Hours**

#### UNIT - 6

**DESIGN OF PRESS TOOLS:** A General study of Press operations. Elements of a Die, Strip layout, calculation of center of pressure. Design of Blanking Die, Design of Piercing Die, Design of Progressive Die. **7 Hours**

#### UNIT - 7

**DESIGN OF FORMING DIES:** Study of Drawing and Bending process, Design of Drawing Die, Design of Bending Die **6 Hours**

## **UNIT - 8**

**TOOL LAYOUT AND CAM DESIGN OF SINGLE SPINDLE AUTOMATS:** Classification of Automats and their applications. Tool layout and Cam design for automatic screw cutting machine. Introduction to form tools. **7 Hours**

### **TEXT BOOKS:**

1. **Text book of Production Engineering** - P. C. Sharma – Chorotar Publishing house.
2. **Tool Design** - Donaldson and Golding – Tata McGraw Hill, New Delhi.

### **REFERENCE BOOKS:**

1. **Fundamentals of Tool Design** -ASTME

## COMPUTER INTEGRATED MANUFACTURING

Subject Code	: 10IP 65	IA Marks	: 25
No. of Lecture Hours./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION:** Scope of CAD/CAM and CIM, Computerized elements of CIM system. **6 Hours**

#### UNIT - 2

**INTRODUCTION TO DIFFERENT COMPUTER HARDWARE:** Introduction, Central Processing Unit (CPU), Types OF Memory, Data Representation, The Design Workstation, The Graphics Terminal, Operator Input Devices, Plotters & Other Output Devices, Secondary Storage. **7 Hours**

#### UNIT - 3

**GROUP TECHNOLOGY:** Part Families, Part classification and Coding, Production Flow Analysis, Machine Cell Design, Benefits of Group Technology. **6 Hours**

#### UNIT - 4

**FLEXIBLE MANUFACTURING SYSTEMS:** What is an FMS? FMS Workstations, Material Handling and Storage System, Computer Control System, Planning the FMS, Analysis of Flexible Manufacturing systems, Applications and Benefits. **7 Hours**

### PART - B

#### UNIT - 5

**SEQUENCE CONTROL, PROGRAMMABLE CONTROLLERS AND COMPUTER PROCESS CONTROL:** Logic Control and Sequencing, Logic Control Elements, Sequencing Elements, Ladder Logic Diagrams, Programmable Logic Controllers. The Computer Process Interface, Interface Hardware, Computer process Monitoring, Types of Computer Process Control, Direct Digital Control, Supervisory Computer Control, Programming for Computer Process Control. **7 Hours**

#### UNIT - 6

**COMPUTERIZED MANUFACTURING PLANNING SYSTEM:** Computer Aided Process Planning, Computer-Integrated Production Planning Systems, Material Requirement Planning, Capacity Planning.

**UNIT - 7**

**SHOP FLOOR CONTROL AND AUTOMATIC IDENTIFICATION**

**TECHNIQUES:** Shop Floor Control, Factory Data Collection Systems, Automatic Identification Systems, Bar Code Technology, Automated Data Collection System.

**6 Hours**

**UNIT - 8**

**COMPUTER NETWORKS IN MANUFACTURING AND FUTURE**

**AUTOMATED FACTORY:** Hierarchy of Computer in Manufacturing, Local Area Networks, Manufacturing Automation Protocol. Trends in Manufacturing, Future Automated Factory, Human workers in the Future Automated factory.

**6 Hours**

**TEXT BOOKS:**

1. **Automation Production Systems and Computer Integrated Manufacturing** - Mikell P. Groover – PHI, New Delhi - 2003.

**REFERENCE BOOKS:**

1. **CAD/CAM** - Mikell P. Groover and Emory W. Zimmers - PHI, New Delhi - 2003.
2. **Numerical Control and Computer aided Manufacture** - Pressman and Williams - PHI – 1991.
3. **An Introduction to Automated Process Planning System** - Tiess Cheiu Chang and Richard A Wysk – PHI – 2002.

## **CAD/CAM LAB**

Subject Code	:	10IPL /IML 67	IA Marks	:	25
No. of Lecture Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Lab Hrs.	:	42	Exam Marks	:	50

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### **PART - A**

Modelling of simple machine parts using Graphics Package.

Study of Finite Element Analysis Package - 1D, 2D, Structural problems, Evaluation of displacement (Strain) and Stress. Problems involving Beams and Trusses.

### **PART - B**

Modelling and Simulation of Machining process of simple machine parts using CAM packages.

Suggested Software Packages: Solid Works/ Uni Graphics/Catia and MASTER CAM or any other similar packages.

Note: A minimum of 12 exercises are to be conducted.

## **MACHINE TOOLS LAB**

Subject Code	: 10IPL 68	IA Marks	: 25
No. of Lecture Hours./ Week	: 03	Exam Hours	: 03
Total No. of Lab Hours.	: 42	Exam Marks	: 50

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### **PART - A**

1. Machining of T - slot or L- slot on milling machine and Checking
  - a. Parallelism between the surfaces.
  - b. Perpendicularity between surfaces.
2. Exercise on Spur Gear cutting and Measurement of all the parameters of the gear.
3. Machining of Spiral slots on milling machine.
4. Measurement of Cutting forces, Determination of Shear angle, Chip Thickness Ratio and Verification of Merchants Angle Relationship in Turning Operation.
5. Study the variation of Axial force and Torque in Drilling with respect to cutting speed and feed.

### **PART – B**

1. A General study of Acceptance test of commonly used machine tool (Theory).
2. Test for True running of the main spindle of Lathe
3. Test for True running of the main spindle of Drill.
4. Alignment of centers in Vertical plane in Lathe.
5. Testing for true running of Headstock center of a Lathe.
6. Disassembly of
  - a) Lathe Tail Stock ,
  - b) Tool Head of a Shaper and measurement of component dimension.

Note: A minimum of 12 exercises are to be conducted.

## Elective I (Group – A)

### VALUE ENGINEERING

Subject Code	: 10IP / IM 661	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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#### PART - A

##### UNIT - 1

**INTRODUCTION TO VALUE ANALYSIS:** Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, Value Analysis versus Traditional cost reduction techniques, uses, applications, advantages and limitations of Value analysis. Symptoms to apply value analysis, Coaching of Champion concept.

**6 Hours**

##### UNIT - 2

**TYPE OF VALUES:** Reasons for unnecessary cost of product, Peeling cost Onion concept, unsuspected areas responsible for higher cost, Value Analysis Zone, attractive features of value analysis. Meaning of Value, types of value & their effect in cost reduction. Value analysis procedure by simulation. Detailed case studies of simple products.

**7 Hours**

##### UNIT - 3

**FUNCTIONAL COST AND ITS EVALUATION:** Meaning of Function and Functional cost, Rules for functional definition, Types of functions, primary and secondary functions using verb and noun, Function evaluation process, Methods of function evaluation. Evaluation of function by comparison, Evaluation of Interacting functions, Evaluation of function from available data, matrix technique, MISS technique, Numerical evaluation of functional relationships and case studies.

**7 Hours**

##### UNIT - 4

**PROBLEM SETTING & SOLVING SYSTEM:** A problem solvable stated is half solved, Steps in problem setting system, Identification, Separation and Grouping of functions. Case studies.

**PROBLEM SETTING & SOLVING SYSTEM:** Goods system contains everything the task requires. Various steps in problem solving, case studies.

**6 Hours**

#### PART - B

##### UNIT - 5

**VALUE ENGINEERING JOB PLAN:** Meaning and Importance of Value Engineering Job plan. Phases of job plan proposed by different value engineering experts, Information phase, Analysis phase, Creative phase, Judgement phase, Development planning phase, and case studies. Cost reduction programs, criteria for cost reduction program, Value analysis change proposal. **6 Hours**

#### **UNIT - 6**

**VALUE ENGINEERING TECHNIQUES:** Result Accelerators or New Value Engineering Techniques, Listing, Role of techniques in Value Engineering, Details with Case examples for each of the Techniques. **6 Hours**

#### **UNIT - 7**

**ADVANCED VALUE ANALYSIS TECHNIQUES:** Functional analysis system technique and case studies, Value Analysis of Management Practice (VAMP), steps involved in VAMP, application of VAMP to Government, University, College, Hospitals, School Problems etc., (service type problems).

**TOTAL VALUE ENGINEERING:** Concepts, need, methodology and benefits. **8 Hours**

#### **UNIT - 8**

**APPLICATION OF VALUE ANALYSIS:** Application of Value analysis in the field of Accounting, Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing, Material Management Etc., Comparison of approach of Value analysis & other management techniques. **6 Hours**

#### **Text Books:**

1. **Techniques of Value Analysis and Engineering** – Lawrence D. Miles - McGraw Hill Book Company - 2<sup>nd</sup> Edn.
2. **Value engineering for Cost Reduction and Product Improvement** – M.S. Vittal - Systems Consultancy Services - Edn 1993.
4. **Value Management, Value Engineering and Cost Reduction** – Edward D Heller - Addison Wesley Publishing Company – 1971.

#### **Reference Books:**

1. **Value Analysis for Better Management** – Warren J Ridge - American Management Association - Edn 1969.
2. **Getting More at Less Cost** (The Value Engineering Way) – G.Jagannathan - Tata Mcgraw Hill Pub. Comp. - Edn 1995.

3. **Value Engineering** – Arther E Mudge - McGraw Hill Book Comp.  
- Edn 1981.

### THEORY OF METAL FORMING

Subject Code	:	10IP / IM 662	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

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#### PART – A

##### UNIT – 1

**BASICS OF PLASTIC DEFORMATION:** Concept of true stress and true strain. Flow stress and strain hardening. State of stress (both biaxial and triaxial). Normal and shear stresses on a inclined plane. Principal stresses and maximum shear stress. Tresca's and Von-Mise's yield criteria and yield surface. **07 Hours**

##### UNIT – 2

**INTRODUCTION TO METAL FORMING:** Classification of forming processes. Importance of temperature in metal forming. Hot and cold working. Effect of strain rate. Friction and its role in metal forming. Influence of metallurgical structure and hydrostatic stress in metal forming. Different methods of analysis of metal forming. **06 Hours**

##### UNIT – 3

**FORGING PROCESS:** Open-die and close-die forging processes. Different types of forging operations. Brief description of the forging machines, equipments and heating furnaces. Slab analysis of upset forging of rectangular slab under plane strain condition and upset forging of circular disc. Forging load calculation. Common forging defects. **06 Hours**

##### UNIT – 4

**ROLLING OF METALS:** Flat rolling and section rolling. Different types of rolling mills. Geometrical considerations in rolling. Role of friction in rolling and neutral point location. Simplified methods for calculating rolling load, torque and power required for rolling. Effect of back and front tension on rolling force. Elastic deformation of rolls, its effect and controlling methods. Residual stresses in rolling and common rolling defects **07 Hours**

#### PART – B

##### UNIT – 5

**EXTRUSION:** Types of extrusion processes. Metal flow pattern in extrusion. Extrusion dies and other equipments used. Extrusion of hollow sections. Slab analysis of extrusion of strips and circular sections and

calculation of force and power required for extrusion. Common extrusion defects.

**07 Hours**

**UNIT – 6**

**DRAWING OF RODS, WIRES AND TUBES:** Drawing equipments and dies. Tandem drawing of wires. Analysis of rod or wire drawing and calculation of draw force and power required. Maximum possible reduction in drawing. Tube drawing using different types of mandrels, residual stresses and defect in drawn products.

**07 Hours**

**UNIT – 7**

**SHEET METAL WORKING:** Classification of sheet metal working and equipments used, Blanking and Piercing operation – Die design, cutting force required, slitting, trimming and shaving operations

Bending operation – Types of bending. Bend angle, bend radius, bend allowance and force required for bending. Springback effect in bending. Roll bending process. Brief description of spinning and stretch forming processes.

**06 Hours**

**UNIT – 8**

**SHEET METAL DRAWING:** Process, Die design, Number of draws required, Blank size calculation, and drawing force necessary. Drawability and defects in drawn products.

**HIGH ENERGY RATE FORMING (HERF):** Introduction to the process and brief description of Explosive forming, Electro discharge forming, and Electromagnetic forming.

**06 Hours**

**TEXT BOOKS:**

1. **Mechanical Metallurgy** - Dieter G.E – McGraw Hill publication.
2. **Fundamentals of Metal Forming Processes** – Juneja B.L - New age International
3. **Principle of Industrial Metal Working Processes** – Rowe Edward - CBS Publication

**REFERENCE BOOKS:**

1. **Materials and Processes in Manufacturing** – E.Paul, DeGarmo et al - PHI publication.
2. **Fundamentals of Working of Metals** – Sach G. - Pergamon press.

## FINITE ELEMENT METHOD

Subject Code	: 10IP / IM 663	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION TO FEM:** Need for use of FEM – Advantages and Disadvantages of FEM Matrix algebra – Terminologies relating to matrices, methods of solution of linear algebraic equations. Eigen values and eigen vectors, Simple numeric Gaussian Quadrature – 1 pt. 2pt and 3pt formula.

**7 Hours**

#### UNIT - 2

**BASIC OF THEORY OF ELASTICITY:** Definition of stress and strain, stress-strain relations; strain-displacement, Relations in 2D and 3D Cartesian and Polar coordinates.

**6 Hours**

#### UNIT – 3

**CONTINUUM METHODS:** Variational methods Raleigh-Ritz method applied to simple problems on axially loaded members cantilever. Simply supported and fixed beam with point loads and UDL Galerkin method as applied to simple elasticity problem.

**7 Hours**

#### UNIT - 4

**FEM- BASIC DEFINITIONS:** Displacement method, Nodal degrees of freedom, different coordinate systems shape functions. Lagrangian polynomial; complete formulation of bar-truss-beam-triangular-quadrilateral Tetrahedral hexahedral elements.

**6 Hours**

### PART - B

#### UNIT - 5

**BOUNDARY CONDITIONS:** SPC and MPC. Methods of handling boundary conditions eliminating method-penalty method. Simple numerical, ISO parametric sub parametric super parametric elements Convergence criteria – requirements of convergence of a displacement model.

**7 Hours**

#### UNIT - 6

**HIGHER ORDER ELEMENTS:** Bar – triangular-quadrilateral elements. Tetrahedral and hexahedral elements (non-Formulation) – Pascal triangle –

Pascal pyramid. Introduction to axis symmetric problems-formulation of axis symmetric triangular element.

**7 Hours**

**UNIT - 7**

**DYNAMIC ANALYSIS:** Formulating-element mass matrices for 1D and 2D element, computation of Eigen value and vector for simple one Dimensional analysis.

**6 Hours**

**UNIT - 8**

One dimensional steady state heat conduction. Formulation of 1D element simple numerical using 1D element. Structure of a commercial FE package. Pre-processor. Solver post processor.

**6 Hours**

**TEXT BOOKS:**

1. **Finite Element Method** - J.N.Reddy – Tat McGraw Hill - edition 2002.
2. **Introduction to Finite elements in engineering** - Chandraupatla and Belegundu – Pearson edn - 2002.

**REFERENCE BOOKS:**

1. **A First course in Finite Element methods** - Daryl.L.Logon - Thomson Learning - 3<sup>rd</sup> edition, 2001.
2. **Fundamentals of Finite Element method** - Hutton – Mc Graw Hill - 2004.
3. **Concepts & applications of FEA** - Robert Cook et,al – Jonh willey & sons - 2002.
4. **Finite element analysis** – Chandrupatla - University press - 2002.
5. **Theory and Practice of Finite elements** - Alexandre ERN - I K International Publishing house Pvt. Ltd – 2004.

## HUMAN RESOURCE MANAGEMENT

Subject Code	: 10IP / IM 664	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART – A

#### UNIT - 1

**INTRODUCTION:** Evolution of HRM, Objectives, Functions and Policies.

**6 Hours**

#### UNIT - 2

**HUMAN RESOURCE PLANNING:** Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting, job Description, Job Specification

**7 Hours**

#### UNIT - 3

**RECRUITMENT:** Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process.

**6 Hours**

#### UNIT - 4

**SELECTION:** Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion, exit interview, (Tutorial on written test, Group Discussion, Interviews)

**7 Hours**

### PART - B

#### UNIT - 5

**TRAINING AND DEVELOPMENT:** Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods.

**7 Hours**

#### UNIT - 6

**PERFORMANCE APPRAISAL:** Components (all round performance appraisal), Methods. Advantages and limitations of different methods, Personal Counselling based on Annual Confidential Reports.

**7 Hours**

#### UNIT - 7

**COUNSELLING AND HUMAN RESOURCE ACCOUNTING:** Characteristics, Need, Function, Types, Suggestions for personnel development, communication function, communication process, effective

communication. Human resource records, Advantages of HR accounting, Various methods of accounting.

**6 Hours**

**UNIT - 8**

**INDUSTRIAL RELATIONS:** Indian trade union act, standing orders act, Indian factories act,

**INDUSTRIAL DISPUTES AND SETTLEMENT:** Indian Industrial Disputes act, Industrial disputes settlement machinery. Works committee, Board of Conciliation, Voluntary Arbitration, Compulsory arbitration, Court of inquiry, Industrial tribunal, Adjudication.

**6 Hours**

**TEXT BOOKS**

1. **Human Resources Management** – Dr. K Ashwathappa - Tata McGraw Hill - Edition 1999.
2. **Management of Human Resources** – CB Mamoria – Himalaya Publication House – 2003.

**REFERENCES BOOKS:**

1. **Personnel / Human resource Management** – Decenoz and robbins - PHI - 2002
2. **Industrial Relations** – Arun Monappa – TMH - ISBN – 0-07-451710-8.
3. **Human Resources Managemetn** – VSP Rao
1. **Human Resources Managemetn** – Ravi Dharma Rao

## ANALYSIS OF MANUFACTURING PROCESSES

Subject Code	:	10IP 665	IA Marks	:	25
No. of Lecture Hours./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours.	:	52	Exam Marks	:	100

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### PART - A

#### UNIT - 1

**ANALYSIS OF CASTING PROCESS:** Gating design for simple vertical gating and Bottom gating. Aspiration effect and Sprue design. Cooling and solidification of casting, rate of solidification. Riser design and placement. (Numerical Treatment). **8 Hours**

#### UNIT - 2

**ANALYSIS OF MACHINING PROCESS:** Estimation of torque and thrust force in drilling operation. Estimation of cutting force and thrust force and power consumption in milling operation. Estimation of tooth spacing and load estimation in Broaching. (Numerical Treatment). **7 Hours**

#### UNIT - 3

**ANALYSIS OF FINISH MACHINING PROCESS:** Components of grinding force. Estimation of uncut thickness, force per single grit and power consumption in grinding. Grinding wheel characteristics, wheel specification and selection, wheel life. (Numerical Treatment). **5 Hours**

#### UNIT - 4

**ECONOMICS OF MACHINING:** Optimization of cutting parameter for minimum cost. Optimizing cutting parameters for maximum production. Optimum cutting speed for maximum efficiency. (Numerical Treatment). **6 Hours**

### PART - B

#### UNIT - 5

**ANALYSIS OF WELDING PROCESS:** Structure and characteristics of arc, Arc efficiency, electrical characteristics of an arc. Requirements for an arc. Welding power source. Volt-ampere characteristics of a welding power source. Process variables in submerged Arc welding, Gas Metal Arc welding (GMAW), Shielded Arc welding (SAW). Economics of welding. (Numerical Treatment). **8 Hours**

#### **UNIT - 6**

**ANALYSIS OF ROLLING AND FORGING:** Assumptions in analysis of rolling. Determination of rolling pressure, roll separating forces, pressure distribution in rolling, torque and power required to drive the rolls, power loss in bearing. (Numerical Treatment).

Assumptions made in open die forging of a flat strip. Determination of maximum force required for forging a strip and a disc between two parallel dies, forging of disc. (Numerical Treatment). **6 Hours**

#### **UNIT - 7**

**ANALYSIS OF ULTRASONIC MACHINING:** Assumptions made in analysis of material removal rate in ultrasonic machining. Calculating material removal rate in USM. Study of process parameters. (Numerical Treatment). **6 Hours**

#### **UNIT - 8**

**ANALYSIS OF ELECTRO-CHEMICAL MACHINING:** Electrochemistry of ECM process, Calculation of material removal rate. Kinematics and dynamics of the process, effect of heat and H<sub>2</sub> bubble generation. Study of factors affecting the surface finish. Tool design ECM. (Numerical Treatment). **6 Hours**

#### **TEXT BOOKS:**

1. **Manufacturing Science** - Amitabh Ghosh and Ashok Kumar Mallik – Affiliated East-West Press Private Ltd.
2. **Welding Processes and Technology** - Dr.R S. Parmar – Khanna Publishers.

#### **REFERENCE BOOK:**

1. **Principles of Machine tools** - Sen and Bhattacharya – Oxford IBM Publishing - 2000.

**VII SEMESTER  
TOTAL QUALITY MANAGEMENT**

Subject Code	: 10IP/IM 71	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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**PART – A**

**UNIT - 1**

**OVERVIEW OF TOTAL QUALITY MANAGEMENT:** History of TQM. Axioms of TQM, contributions of Quality Gurus – Deming’s approach, Juran,s quality trilogy, Crosby and quality treatment, Imai’s Kaizen, Ishikawa;s company wide quality control, and Fegenbaum;s theory of TQC, QFD.

**7 Hours**

**UNIT - 2**

**EVOLUTION OF QUALITY CONCEPTS AND METHODS:** Quality concepts. Development of four fitnesses, evolution of methodology, evolution of company integration, quality of conformance versus quality of design from deviations to weaknesses to opportunities. Future fitness’s, four revolutions in management thinking, and four levels of practice

**7 Hours**

**UNIT - 3**

**FOUR REVOLUTIONS IN MANAGEMENT THINKING:** Customer focus, Continuous Improvement, Total participation, and Societal Networking. **FOCUS ON CUSTOMERS;** Change in work concept marketing, and customers.

**6 Hours**

**UNIT - 4**

**CONTINUOUS IMPROVEMENT:** Improvement as problem solving process; Management by process, WV model of continuous improvement, process control, process control and process improvement, process versus creativity. Reactive Improvement; Identifying the problem, standard steps and tools, seven steps case study, seven QC tools.

**6 Hours**

**PART - B**

**UNIT - 5**

**PROACTIVE IMPROVEMENT:** Management diagnosis of seven steps of reactive improvement. General guidelines for management diagnosis of a QI story, Discussion on case study for diagnosis of the seven steps. Proactive Improvement; Introduction to proactive improvement, standard steps for

proactive improvement, semantics, example-customer visitation, Applying proactive improvement to develop new products- three stages and nine steps.

**6 Hours**

#### **UNIT - 6**

**TOTAL PARTICIPATION:** Teamwork skill. Dual function of work, teams and teamwork, principles for activating teamwork, creativity in team processes, Initiation strategies, CEO involvement Example strategies for TQM introduction. Infrastructure for mobilization. Goal setting (Vision/ Mission), organization setting, training and E education, promotional activities, diffusion of success stories, awards and incentives monitoring and diagnosis, phase-in, orientation phase, alignment phase, evolution of the parallel organization.

**6 Hours**

#### **UNIT - 7**

**HOSHIN MANAGEMENT:** Definition, phases in hosing management- strategic planning (proactive), hoshin deployment, controlling with metiers (control), check and act (reactive). Hoshin management versus management by objective, hoshin management and conventional business planning, an alternative hoshin deployment system, hoshin management as “systems Engineering” for alignment.

**6 Hours**

#### **UNIT - 8**

**SOCIETAL NETWORKING:** Networking and societal diffusion – Regional and nationwide networking, infrastructure for networking, openness with real cases, change agents, Center for quality Management case study, dynamics of a societal learning system. TQM as learning system, keeping pace with the need for skill, a TQM model for skill development, summary of skill development.

**8 Hours**

#### **TEXT BOOKS:**

1. **A New American TQM Four Practical Revolutions in Management** - Shoji Shiba, Alan Graham and David Walden – Productivity Press, Portlans (USA) – 1993.
2. **Management for Total Quality** - N Logothetis - Prentice Hall of India, New Delhi - 1994.(1<sup>st</sup> Chapter)

#### **REFERENCE BOOK:**

1. **The Quality Improvement Hand Book** - Roger C Swanson - Publisher Vanity Books International, New Delhi - 1995.
2. **Total Quality Management** - Kesavan R - I K International Publishing house Pvt. Ltd – 2008.

## OPERATIONS MANAGEMENT

Subject Code	: 10IP/IM 72	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**OPERATIONS MANAGEMENT CONCEPTS:** Introduction, Historical development, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity, International dimensions of productivity, The environment of operations, Production systems decisions- a look ahead.

**6 Hours**

#### UNIT - 2

**OPERATIONS DECISION MAKING:**

Introduction, Management as a science, Characteristics of decisions, Framework for decision making, Decision methodology, Decision support systems, Economic models, Statistical models.

**SYSTEM DESIGN AND CAPACITY:**

Introduction, Manufacturing and service systems, Design and systems capacity, Capacity planning.

**7 Hours**

#### UNIT - 3

**FORECASTING DEMAND:**

Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Exponential smoothing, Regression and correlation methods, Application and control of forecasts.

**7 Hours**

#### UNIT - 4

**AGGREGATE PLANNING AND MASTER SCHEDULING:**

Introduction- planning and scheduling, Objectives of aggregate planning, Aggregate planning methods, Master scheduling objectives, Master scheduling methods.

**6 Hours**

### PART - B

#### UNIT-5

**MATERIAL AND CAPACITY REQUIREMENTS PLANNING:**

Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.

**6 Hours**

#### **UNIT - 6**

##### **SCHEDULING AND CONTROLLING PRODUCTION ACTIVITIES:**

Introduction, PAC, Objectives and Data requirements, Scheduling strategy and guide lines, Scheduling methodology, priority control, capacity control.

**6 Hours**

#### **UNIT - 7**

**SINGLE MACHINE SCHEDULING:** Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule, minimizing the number of tardy jobs.

**FLOW -SHOP SCHEDULING:** Introduction, Johnson's rule for 'n' jobs on 2 and 3 machines, CDS heuristic.

**JOB-SHOP SCHEDULING:** Types of schedules, Heuristic procedure, scheduling 2 jobs on 'm' machines.

**7 Hours**

#### **UNIT - 8**

**LEAN SYSTEMS:** Characteristics of Just-in-Time operations, Pull method of materials flow, consistently high quality, small lot sizes, Uniform workstation loads, Standardized components and work methods, close supplier Ties, Flexible workforce, Line flows, Automated production, Preventive maintenance, continuous improvement, Kaizen.

**7 Hours**

#### **TEXT BOOKS:**

1. **Operations Management** - Monks J.G. - McGraw-Hill International Editions - 1987.
2. **Production and Operations Management** - Pannerselvam. R – PHI - 2<sup>nd</sup> edition.
3. **An introductory book on lean systems, TPS**, Yasuhiro Monden

#### **REFERENCE BOOKS:**

1. **Modern Production/Operations Management** - Buffa - Wiely India Ltd. - 4<sup>th</sup> edition.
2. **Production and Operations Management** - Chary, S.N - Tata-McGraw Hill. - 3<sup>rd</sup> edition

3. **Production and Operatiosn Management** – Adam & Ebert, PHI,  
5<sup>th</sup> edition

**NON CONVENTIONAL MACHINING PROCESSES**

Subject Code	:	10IP73	IA Marks	:	25
No. of Lecture Hours./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours.	:	52	Exam Marks	:	100

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**PART - A**

**UNIT - 1**

**INTRODUCTION:** History, Need for non-traditional machining methods, Comparison between Conventional and Non-Conventional Machining Process, Classification.

**MECHANICAL PROCESS:** Ultrasonic machining (USM) : Introduction, Equipment, tool materials & tool Size, Abrasive slurry, Cutting tool system design : Mechanics of cutting : Theory of Miller & Shaw, Effect of parameter : Effect of amplitude and frequency of vibration, Effect of grain diameter, Effect of applied static load, Effect of slurry, Tool and work material, USM process characteristics , Material removal rate, tool wear, Accuracy, surface finish., Applications, Advantages & Disadvantages of USM. **8 Hours**

**UNIT - 2**

**ABRASIVE JET MACHINING (AJM):** Introduction, Equipment, Variables in AJM: carrier gas, Type of abrasives, Size of abrasive grain, velocity of the abrasive jet, Mean No. 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. **6 Hours**

**UNIT - 3**

**ELECTRON BEAM MACHINING (EBM):** Introduction-Equipment for production of Electron beam – Theory of electron beam machining – Thermal & Non thermal types, characteristics – applications.

**LASER BEAM MACHINING (LBM):** Introduction-principle of generation of lasers, Equipment and Machining procedure-Types of Lasers-Process characteristics-advantages and limitations-applications. **6 Hours**

#### **UNIT - 4**

#### **ELECTROCHEMICAL AND CHEMICAL METAL REMOVAL PROCESS:**

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.

Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations. **6 Hours**

#### **PART - B**

#### **UNIT - 5**

**CHEMICAL MACHINING (CHM):** Introduction, Elements of the process  
Chemical blanking process: - Preparation of work piece. Preparation of masters, masking with photo resists, etching for 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. **7 Hours**

#### **UNIT - 6**

#### **EDM PROCESS:**

Introduction, machine, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design, electrode material selection, under sizing and length of electrode, Machining time. **7 Hours**

#### **UNIT - 7**

#### **EDM PROCESS CHARACTERISTICS:**

Flushing – Pressure flushing synchronized with electrode movement, EDM process characteristic: Metal removal rate, Accuracy surface finish, Heat affected Zone. Machine tool selection, Application: EDM accessories / applications, electrical discharge grinding, Travelling wire EDM. **6 Hours**

#### **UNIT - 8**

#### **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. **6 Hours**

#### **Text Books:**

1. **Modern machining process** - PANDEY AND SHAH - TATA McGraw Hill -2000.

**Reference Books:**

1. **Production Technology** - HMT - TATA McGraw Hill - 2001.
2. **Fundamentals of Machining and Machine Tools** - R.K.Singal - I K International Publishing house Pvt. Ltd
3. **Thermal Metal Cutting Process** - Dr. B.J. Ranganath - I.K. International, New Delhi – 2008.

**MECHATRONICS**

Subject Code	: 10IP 74	IA Marks	: 25
No. of Lecture Hours./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours.	: 52	Exam Marks	: 100

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**PART - A****UNIT - 1**

**INTRODUCTION:** Definition of Mechatronics, Multi-disciplinary scenario, Evaluation of Mechatronics, Objectives, Advantages & Disadvantages of Mechatronics, An Overview of Mechatronics, Microprocessor Based Controllers, Principle of Working of Automatic Camera, Automatic Washing Machine & Engine Management System. **6 Hours**

**UNIT - 2**

**REVIEW OF SENSORS AND TRANSDUCERS:** Definition and Classification of Transducers, Definition & Classification of Sensors, Working Principle and Application of Displacement, Position & Proximity, Velocity and Motion, Force, Fluid pressure, Liquid flow, Liquid level, Temperature, Light sensors, Selection of transducers. **6 Hours**

**UNIT - 3**

**DIGITAL PRINCIPLES:** Introduction, Digital Number System, Range and Weight of Binary Number System, Octal and Hexadecimal Number Systems, Conversion, BCD Number Systems, Gray Code, Boolean Algebra, Logic States, Logic Functions, More Logic Gates, Universal Gates, Exclusive-OR Gate, Combinational and Sequential Logic Circuits, Flip-Flops, Minimization of Boolean Expression, Karnaugh Map, TTL and CMOS, Memory. **7 Hours**

**UNIT - 4**

**MICROPROCESSOR:** Intel 8085, ALU, Timing and Control Unit, Registers, Data and Address Bus, Pin Configuration, Intel 8085 Instructions, Op code and Operands, Instruction Word Size, Instruction Cycle, Fetch Operation, Execute Operation, Machine Cycle and State, Instruction and Data Flow, Timing Diagram, Timing Diagram for Op code Fetch Cycle, Memory

Read, I/O Read, Memory Write, I/O Write, Instruction and Data Formats, Addressing Modes, Direct Addressing, Register Addressing, Register Indirect Addressing, Immediate Addressing, Implicit Addressing. **7 Hours**

## **PART - B**

### **UNIT - 5**

**MICRO CONTROLLER:** Introduction to microcontrollers, Intel 8051 Microcontroller Architecture and Pin diagram, Selection and Application of Microcontroller. **6 Hours**

### **UNIT - 6**

**PLC:** Programmable Logic Controllers, Basic Structure, Input/Output Processing, Programming, Mnemonics, Timers, Internal Relays and Counters, Shift Registers, Master and Jump controls, Data handling, Analogue input/output, Selection of a PLC. **7 Hours**

### **UNIT - 7**

**ACTUATORS:** Definition, Classification of Actuators, Brief survey of Electromechanical actuators, Drive requirements for cutting movements, Requirements of feed drives, Calculation of drive requirements on feed motor shaft, DC motors & Control of DC motors, AC motors, DC & AC servomotors, Stepper motors- types, Characteristics, advantages, limitations and applications. **7 Hours**

### **UNIT - 8**

**SYSTEM MODELS:** Mathematical models, Mechanical system building blocks, Electrical system building blocks, Fluid system building blocks, Thermal system building blocks. **6 Hours**

### **TEXT BOOKS:**

1. **Mechatronics** - W. Bolton – Pearson Education Asia - 2<sup>nd</sup> Edition, 2001.
2. **Fundamentals of Microprocessor and Micro Computer** - B. Ram - Dhanpat Rai and Sons - 4<sup>th</sup> Revised Edition.

### **REFERENCE BOOKS:**

1. **Mechatronics Principles, Concepts and Application** - Nitaigour and Premchand, Mahilik – Tata McGraw Hill - 2003.

2. **Mechatronics** by HMT - TMH.

**SOFTWARE APPLICATIONS LAB**

Subject Code	:	10IPL 77	IA Marks	:	25
No. of Lab Hours./ Week	:	03	Exam Hours	:	03
Total No. of Lab Hours.	:	42	Exam Marks	:	50

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**PART - A**

1. Development of simple MIS application programs for use in :  
(i) Library, (ii) Bank, (iii) Business shop, and (iv) Hospital
2. Regression and Correlation analysis using any of the statistical packages.

**PART -B**

3. Plotting Quality control chart using software packages.
4. Use of software package to solve Operation Research (LPP) problems.  
Plotting appropriate charts and diagrams relevant to various industrial applications.

**Reference Book:**

Lab manual prepared by the department/institution.

Suggested Software Packages: Oracle / MS SQL Server as the back-end, and VB6.0 / Developer2000 as the front-end tools, SYSTAT and OR Packages.

Note: A minimum of 12 exercisers are to be conducted

### **CNC AND ROBOTICS LAB**

Subject Code	:	10IPL 78	IA Marks	:	25
No. of Lab Hours./ Week	:	03	Exam Hours	:	03
Total No. of Lab Hours.	:	42	Exam Marks	:	50

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#### **PART - A**

1. Study of functions assigned to Alphabets and Symbols. G and M codes, grouping of codes, Assigned and Unassigned, Model and Non Model codes.
2. Writing the program for Contour Milling - 4 exercises
3. Writing the program using Canned Cycles, Subroutine Programs for Drilling, Reaming and Thread Cutting - 4 exercises
4. Introductory concept of loop in loop program - 2 exercises.

#### **Note:**

1. The programs should be written with reference to one user manual provided by manufacture of control unit.
2. Atleast 10 programs must be simulated.

#### **PART - B**

- 1 Writing CNC program for Lathe - 2 exercises.
- 2 Exercises on Robots (only demonstration)
  - a. Study of a General Configuration of a Robot.
  - b. Study of Programming methods
  - c. Study of Overview of Robot languages.

Atleast 4 programs to be discussed with specific applications

Note: A minimum of 12 exercisers are to be conducted

## ELECTIVE-II (GROUP B)

### ENTERPRISE RESOURCE PLANNING

Subject Code	: 10IP / IM 751	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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#### PART - A

##### UNIT - 1

**INTRODUCTION TO ERP:** Introduction, Evolution of ERP, What is ERP?, Reasons for the growth of the ERP market, The advantages of ERP, Why do Man ERP Implementations Fail? Why are ERP packages being used now?

**ENTERPRISE – AN OVERVIEW:** Introduction, Integrated Management Information, Business modelling, Integrated Data Model.

**7 Hours**

##### UNIT - 2

**ERP AND RELATED TECHNOLOGIES:** Introduction, Business Process Reengineering, Management Information System, Decision Support System, Executive Information Systems, Data Warehousing, Data Mining, On-line Analytical Processing, Supply Chain Management.

**7 Hours**

##### UNIT - 3

**ERP- MANUFACTURING PERSPECTIVE:** Introduction, ERP. CAD/CAM, Materials Requirements Planning, Bill of Material, Closed Loop MRP. Manufacturing Resource Planning, Distribution Requirements Planning.

**6 Hours**

##### UNIT - 4

**KANBAN:** JIT and Kanban, Product Data Management, Benefits of PDM, Make-to-order, and Make-to Stock, Assemble to order, Engineer to order, Configure-to order.

**6 Hours**

#### PART - B

##### UNIT - 5

**ERP MODULES:** Introduction, Finance, Plant Maintenance, Quality Management, Materials Management.

**6 Hours**

**UNIT - 6**

**BENEFITS OF ERP:** Introduction, Reduction of Lead time, On-time shipment, Reduction in Cycle Time, Improved Resource Utilisation, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Decision – making capability.

**6 Hours**

**UNIT - 7**

**ERP MARKET:** Overview of ERP Software Introduction, SAP AG, Baan Company, Oracle Corporation, PeopleSoft, JD Edwards World Solutions Company, System Software Associates, Inc. QAD

**6 Hours**

**UNIT - 8**

**ERP Implementation Life Cycle:** Pre-Evaluations Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation of Team Training, Testing, Going Live, end user Training, Post Implementation

**VENDOR, CONSULTANTS AND USERS:** Introduction, In-house implementation – Pros and Cons, Vendors, Consultants, End-users.

**FUTURE DIRECTION IN ERP:** Introductions, New Markets, New Channels, Faster Implementation Methodologies, Business models and BAPIs, Convergence on Windows NT, Application Platforms, New business segments, web enabling, market snapshot

**ERP-** Case studies

**8 Hours**

**TEXT BOOKS:**

1. **Enterprise Resource Planning** - Alexis Leon - Tata Mc Graw Hill Publishing Company Ltd.- 1999.
2. **Enterprise Resource Planning Concept and Practice** - Vinod Kumar Garg and Venkitakrishnan – Prentice Hall, India - 2<sup>nd</sup> Edition.

**REFERENCE TEXT BOOK:**

1. **Manufacturing Planning & Controls** - Thomas Volloman - et, al.

## **CONCURRENT ENGINEERING**

Subject Code	: 10IP/IM 752	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### **PART - A**

#### **UNIT - 1**

**MANUFACTURING COMPETITIVENESS:** Review, Product and Services, Process and Methodologies, performance, the need for change, Sequential versus concurrent Engg.

**7 Hours**

#### **UNIT - 2**

**PROCESS REENGINEERING:** Managing change, Reengineering approaches, Enterprise models, concurrent process reengineering.

**7 Hours**

#### **UNIT - 3**

**CONCURRENT ENGINEERING:** Introduction, Basic principles, components of CE models.

**6 Hours**

#### **UNIT - 4**

**CONCURRENT ENGINEERING ORGANIZATIONS:** Benefits, co-operative concurrent teams, Types of CE organisations.

**6 Hours**

### **PART - B**

#### **UNIT - 5**

**SYSTEM ENGINEERING:** Introduction, System thinking, System complexity, System Integration, Angle virtual company.

**6 Hours**

#### **UNIT - 6**

**INFORMATION MODELLING:** Methodology, foundation of information modelling.

**6 Hours**

#### **UNIT - 7**

**C. E. PROCESS:** Concurrent engineering process invariant enterprise model class, product mode class, cognitive models.

**6 Hours**

**UNIT - 8**

**CE METRICS FOR IT:** Based manufacturing – process efficiency metrics,  
Process effectiveness metrics.

**8 Hours**

**TEXT BOOK:**

1. **Concurrent Engineering Fundamentals** - Prasad.B - Integrated Product and process organization Vol. 1 & 2, Prentice Hall Englewood, Cliffs, New Jersey -1996.
2. **Concurrent Engineering** - Hartely R John – Shortening lead times, raising quality & Lowering costs, Productivity press, Portland, Oregon -1992.

**REFERENCE BOOKS:**

1. **Concurrent Engineering** - Carter DE & Baker BS - The product development environment for the 1990's. Addison – Wesley Publishing company, Reading MA -1992.

## MARKETING MANAGEMENT

Subject Code	: 10IP/IM 753	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION:** Historical development of marketing management, Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and Macro Environment, importance of marketing in the India Socio – economics system.

**7 Hours**

#### UNIT - 2

**CONSUMER MARKETS AND BUYING BEHAVIOR:** Characteristics affecting consumer behaviour, Types of buying decisions, Buying decision process, Classification of consumer products, Market segmentation.

**6 Hours**

#### UNIT - 3

**MARKETING INFORMATION SYSTEMS AND RESEARCH:** Components of marketing information system–benefits & uses marketing research system, marketing research procedure, measurement of market demand.

**6 Hours**

#### UNIT - 4

**MARKETING OF INDUSTRIAL GOODS:** Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behaviour, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users

**7 Hours**

### PART - B

#### UNIT - 5

**PRODUCT PLANNING AND DEVELOPMENT:** The concept of a product, features of a product, classification of products, product policies –

product planning and development, product line, product mix – factors influencing change in product mix, product mix strategies, meaning of New – product; major stages in new – product development, product life cycle.

**7 Hours**

#### **UNIT - 6**

**BRANDING, LABELLING AND PACKAGING:** Branding, Reasons for branding, functions of branding, features and types of brands, kinds of brand name.

**LABELLING:** Types, functions, advantages and disadvantages

**PACKAGING:** Meaning, growth of packaging, function of packaging, kinds of packaging.

**6 Hours**

#### **UNIT - 7**

**PRICING:** Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions.

**DISTRIBUTION:** Marketing channels – functions, types of channels of distribution, number of channel levels. Physical distribution – importance, total systems concept, strategy, use of physical distribution.

**7 Hours**

#### **UNIT - 8**

**ADVERTISING AND SALES PROMOTION:** Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion.

**PERSONAL SELLING:** Objectives of personal selling, establishing the Sales force objectives, sales – force strategy, sales force structure and size, salesmanship, qualities of good salesman, types of salesman, major steps in effective selling.

**6 Hours**

#### **TEXT BOOKS:**

1. **Principles of Marketing** - Philip Kotler - Prentice Hall - 11<sup>th</sup> Edn.
2. **Marketing Management** - Philip Kotler , Prentice Hall - 12<sup>th</sup> Edn.

#### **REFERENCE BOOKS:**

1. **Fundamentals of Marketing** - Wiliam J Stanton - McGraw Hill – 1994.
2. **Marketing Management Text & Cases** - Rajagopal - Vikas Publishing House - ISBN 81-259-0773-4.
3. **Marketing Management** - Michael R Czinkota - Vikas Publishing House - 2<sup>nd</sup> Edition ISBN 981-240-366-3.

**TECHNOLOGY MANAGEMENT**

Subject Code	: 10IP/IM 754	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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**PART - A**

**UNIT - 1**

**THE CONCEPT OF TECHNOLOGY:** Introduction, The nature of knowledge, Aspects of classification, Concept and Meaning of technology, The character of a specific technology, Scope of technology, Examples of classification of technology, Scale of technology information, Levels of technology, Technology portfolios, Technology as an environment.

**6 Hours**

**UNIT - 2**

**THE NATURE OF TECHNOLOGICAL CHANGE:** Introduction, Meaning of technological change, Concept of invention, Nature of innovation, Emergence of new technologies, Life cycle of a technology, Motivation for technological change, Nature of technological progress, Nature of mature technology, Nature of diffusion, Technological convergence.

**7 Hours**

**UNIT - 3**

**THE ECONOMICS OF TECHNOLOGY:** Introduction, Meaning of technological economics, Examples of technological economics, Scope of technological economics, Engineering economics, Production economics, Concept of economy of scale, Concept of optimum size, Technology as a commodity, Technology at the macro-economic level.

**7 Hours**

**UNIT - 4**

**CORPORATE TECHNOLOGY STRATEGY:** Introduction, The Business Mission, Where Is The Business? Concept Of Business Strategy, Capability For Strategic Planning, Corporate Technology Strategy, Competitive Technology, Focus Of Strategy, Technological Alliances, Realization Of Strategy, Technology Crisis.

**6 Hours**

**PART - B**

**UNIT - 5**

**ANALYSIS FOR TECHNOLOGY STRATEGY:** Introduction, Technology assessment, Technology forecasting, Main techniques of technology forecasting, Technology forecasting system, Yield of technology forecasting.

**7 Hours**

**UNIT - 6**

**THE REALIZATION OF NEW TECHNOLOGY:** Introduction, Concept of R&D policy, Stimuli for innovation, Sources of innovation, Intelligence function of R&D, Management of R&D, R&D team, Effectiveness of R&D, Marketing aspects of R&D, Finance for Design, Development, Manufacture and Marketing, reduction of development lead time, Patterns for new technology development, Remaining a going concern.

**7 Hours**

**UNIT - 7**

**THE ADOPTION OF NEW MANUFACTURING TECHNOLOGY:** Introduction, manufacturing strategy, Introduction of new technology, Challenges of factory automation, Stages of factory automation, Manufacturing FMS, CIM, CAD/CAM, Intelligent manufacturing systems, operation of new technology, Change management, People and technology at work, Work structures.

**6 Hours**

**UNIT - 8**

**TECHNOLOGY- AN INSTRUMENT OF COMPETITION:** Introduction, securing competitive advantage, Technological competition analysis, Technological leadership, Adoption of new technology, marketing a new technology product, Retention of competitive advantages.

**6 Hours**

**TEXT BOOK:**

1. **The Management of Technology Perceptions & Opportunities** - Paul Lowe - Chapman & Hall, London - 1995.

**REFERENCE BOOKS:**

1. **Strategic Management of Technology** - Frederick Betz – McGraw-Hill Inc - 1993.
2. **Management of Technology & Innovation competing Through Technological Excellence** - Rastogi P.N. - Sage Publications - 1995 .
3. **Mastering the dynamics of innovation** – J Utterback

## SIMULATION MODELING & ANALYSIS

Subject Code	: 10IP 755	IA Marks	: 25
No. of Lecture Hours./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION TO SIMULATION:** Simulation, advantages, Disadvantages, Areas of application, System environment, Components of a system, Model of a system, Types of models, Steps in a simulation study.

**7 Hours**

#### UNIT - 2

**SIMULATION EXAMPLES:** Simulation of Queuing systems, Simulation of Inventory System, Other simulation examples.

**6 Hours**

#### UNIT - 3

**GENERAL PRINCIPLES:** Concepts in discrete - events simulation, event scheduling / Time advance algorithm, simulation using event scheduling.

**6 Hours**

#### UNIT - 4

**RANDOM NUMBERS:** Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Autocorrelation test, Gap test, Poker test

**7 Hours**

### PART - B

#### UNIT - 5

**RAMDOM VARIATE GENERATION:** Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods- Erlang distribution, Acceptance – Rejection Techniques – Poisson Distribution, Gamma Distribution.

**6 Hours**

#### UNIT - 6

**ANALYSIS OF SIMULATION DATA: Input Modelling:** Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis

**Verification and Validation of Model** – Model Building, Verification, Calibration and Validation of Models.

**7 Hours**

**UNIT - 7**

**OUTPUT ANALYSIS:** Stochastic Nature of output data, Measures of Performance and their estimation, Output analysis of terminating simulation, Output analysis of steady state simulations

**6Hours**

**UNIT - 8**

**OPTIMISATION VIA SIMULATION:** Meaning, difficulty, Robust Heuristics, Random Search

**APPLICATIONS**

Simulation of Manufacturing and Material Handling Systems, Simulation of Computer Systems, Simulation of Plant Layout, Simulation of Project Management

**SIMULATION SOFTWARES**

Selection of Simulation Software, Simulation packages, Experiment and Statistical Analysis tool, Trend in Simulation Software

**7 Hours**

**TEXT BOOKS:**

1. **Discrete Event system Simulation** – Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol - Pearson Education, Asia - III Edition - ISBN - 81- 7808 – 505 - 4.

**REFERENCE BOOKS:**

1. **Systems Simulation with Digital Computer** – Narsingh Deo - PHI Publication (EEE) - ISBN – 0-87692-028-8.
2. **Simulation Modelling & Analysis** – Averill M Law, W David Kelton - McGraw Hill International Editions – Industrial Engineering series, ISBN – 0-07-100803-9.

### **ELECTIVE III (GROUP C)**

#### **FINANCIAL MANAGEMENT**

Subject Code	: 10IP/IM 761	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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#### **PART - A**

##### **UNIT - 1**

**INTRODUCTION:** Evolution of Financial Management, Goals, Forms of Business.

**RISK AND REQUIRED RETURN:** Risk and return relationship, Business risk, financial risk, and risk in portfolio context, expected rate of return, Capital asset pricing model.

**7 Hours**

##### **UNIT - 2**

**CAPITAL BUDGETING:** Risk analysis in Capital Budgeting, Cost of Capital – Debt, Preference Equity forms of capital.

**WORKING CAPITAL MANAGEMENT:** Factors influencing working capital requirement, determination of operating cycle and working capital.

**7 Hours**

##### **UNIT - 3**

**LONG TERM FINANCING:** Raising of finance form primary and secondary markets, Valuation of securities, features of convertibility securities and warrants, SEBI guide lines on capital issues, stock market in India, Venture capital, Initial Public Offering.

**7 Hours**

##### **UNIT - 4**

**CAPITAL STRUCTURE AND FIRM VALUE:** Assumption, Definition and approaches, Modigliani and Miller Mode, Capital Structure decisions – EBIT, EPS analysis, ROI, REI analysis and Cash Flow comparative Analysis

**DIVIDEND VALUE AND FIRM VALUE:** Models, Reasons for payment of dividends, Dividend Policy, Bonus shares and stock splits, Dividend policies in practice.

**6 Hours**

**PART - B**

**UNIT - 5**

**SECURITIES AND PORTFOLIO ANALYSIS:** Derivatives, Futures Trading,

**6 Hours**

**UNIT - 6**

**MERGER ACQUISITION AND RESTRUCTURING:** Reasons, Mechanics, Cost and benefits of a merger, Evolution, terms and purchase of a division, Takeovers, Acquisitions, Portfolio and financial restructuring.

**6 Hours**

**UNIT - 7**

**INTERNATIONAL FINANCIAL MANAGEMENT:** World Monitoring system, Foreign Exchange Markets, International Parity Relationships, International Capital budgeting, Financing Foreign Operations, Raising Foreign Currency Finance, Financing Exports, Documents in International Trade, Foreign Exchange Exposure, Management of Foreign Exchange Exposure.

**6 Hours**

**UNIT - 8**

**FINANCIAL MANAGEMENT IN SICK UNITS:** Definition of sickness, Causes of sickness, Symptoms of sickness, Prediction of sickness, Revival of a sick unit

**7 Hours**

**TEXT BOOKS:**

1. **Financial Management Theory and practice** - Prasanna Chandra - TMH - ISBN- 0-07-044501-X, 5<sup>th</sup> edn.
2. **Financial accounting** - B.S. Raman - United publication - VoI II

**REFERENCE BOOKS:**

1. **Financial Management Text & Problems** - Khan & Jain - TMH - ISBN 0—07-460208-X.
2. **Financial management** - IM Pandey - Vikas Pub. House - ISBN 0-7069-5435-1.

## **PROJECT MANAGEMENT**

Subject Code	: 10IP/IM 762	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### **PART - A**

#### **UNIT - 1**

**CONCEPTS OF PROJECT MANAGEMENT:** Concepts of a Project, Categories of projects, Phases of project life cycle, Roles and responsibility of project leader, tools and techniques for project management.

**6 Hours**

#### **UNIT - 2**

**PROJECT PLANNING AND ESTIMATING:** Feasibility report, phased planning, Project planning steps, Objective and goals of the project, preparation of cost estimation, evaluation of the project profitability.

**7 Hours**

#### **UNIT - 3**

**ORGANIZING AND STAFFING THE PROJECT TEAM:** Skills / abilities required for project manager, Authorities and responsibilities of project manager, Project organization and types accountability in project execution, controls, tendering and selection of contractors.

**7 Hours**

#### **UNIT - 4**

**PROJECT SCHEDULING:** Project implementation scheduling, effective time management, different scheduling techniques, resources allocation method.

**6 Hours**

### **PART - B**

#### **UNIT - 5**

**TOOLS & TECHNIQUES OF PROJECT MANAGEMENT:** Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Planning, Computerized project management

**7 Hours**

**UNIT - 6**

**CO-ORDINATION AND CONTROL:** Project direction communication in a project, MIS project co-ordination, project control requirement for better control of project or role of MIS in project control, performance, control, schedule control, cost Control

**7 Hours**

**UNIT - 7**

**PERFORMANCE MEASURES IN PROJECT MANAGEMENT:** Performance indicators, Performance improvement for the CM & DM companies for better project management, project management and environment, Software Project Management, Construction Project Management.

**6 Hours**

**UNIT – 8**

**CASE STUDIES ON PROJECT MANAGEMENT:** Over view of project management software, Case studies covering project planning, scheduling, use of tools & techniques, performance measurement.

**6 Hours**

**TEXT BOOKS:**

1. **Project Management a System approach to Planning Scheduling & Controlling** - Harold Kerzner - CBS Publishers and Distributors - 2002.
2. **Project Execution Plan: Plan for project Execution interaction** - Chaudhry S.- 2001

**REFERENCES BOOKS:**

1. **A Management Guide to PERT and CPM** - WEIST & LeVY - Eastern Economy of PH 2002.
2. **PERT & CPM.**- L.S.Srinnath - Affiliated East West Press Pvt. Ltd. - 2002.
3. **Project Management with PERT and CPM** - Moder Joseph and Philips cerel R.
4. **Project planning analysis selection implementation & review** – Prasanna Chandra -ISBN0-07-462049-5 – 2002.

## COMPOSITE MATERIALS

Subject Code	: 10IP/IM 763	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION TO COMPOSITE MATERIALS:** Definition, classification and characteristics of composite materials – fibrous composites, laminated composites, particulate composites. Properties and types of reinforcement and matrix materials.

**6 Hours**

#### UNIT - 2

**FIBRE REINFORCEMENT 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, injection molding, liquid molding, blow molding.

**7 Hours**

#### UNIT - 3

**FABRICATION OF COMPOSITES:** Cutting, machining, drilling, mechanical fasteners and adhesive bonding, joining, computer aided design and manufacturing, tooling, fabrication equipment.

**7 Hours**

#### UNIT - 4

Ceramic Matrix composites and their fabrication technologies.

**6 Hours**

### PART - B

#### UNIT - 5

Application of composites Characterisation of composites, computer aided design and analysis of composites

**7 Hours**

#### UNIT - 6

Application of industrial experimentation for fabrication and testing of composites

**6 Hours**

**UNIT - 7**

**STUDY PROPERTIES OF MMC'S:** Physical Mechanical, wear, machinability and other properties. Effect of size, shape and distribution of particulate on properties.

**7 Hours**

**UNIT - 8**

Advanced composites such as Polymer based Sandwich structures of nano composites.

**5 Hours**

Introduction to shape memory alloys.

**2 Hours**

**TEXT BOOKS:**

1. **Composite Science and Engineering** - K.K.Chawla - Springer Verlag -1998.
2. **Introduction to composite materials** - Hull and Clyne - Cambridge University Press - 2<sup>nd</sup> Edition, 1990.
3. **Composite Materials** - S.C. Sharma - Narora publishing house - 2000.

**REFERENCE BOOKS:**

1. **Composite Materials hand book** - Meing Schwaitz - McGraw Hill Book Company - 1984.
2. **Forming Metal hand book** - 9<sup>th</sup> edition, ASM handbook, V15, 1988, P327-338.
3. **Mechanics of composites** - Autar K kaw - CRC Press - 2002.

## WORLD CLASS MANUFACTURING

Subject Code	: 10IP/IM 764	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

##### **INTRODUCTION TO WORLD CLASS MANUFACTURING:**

Manufacturing Excellence and Competitiveness, What is world-Class Manufacturing?-Hall's framework of world-Class Manufacturing (WCM), Gunn's Model of World-Class Manufacturing, Maskell's Model of World-Class Manufacturing, America's Best Plants Model of World Class Manufacturing.

**6 Hours**

#### UNIT - 2

**WORLD CLASS MANUFACTURING:** The philosophy of world-class Manufacturing-The First Principles of World-Class Manufacturing, The practices of World-Class Manufacturing-The customers Interface, The Supplier Interface, World-Class Practices in the factory, Quality Management, Shingo's.

**7 Hours**

#### UNIT - 3

**PRINCIPLES AND PRACTICES OF WCM:** Data collection plan, research-internal public domain sources, outside experts etc. original research, site visits, and code of conduct. Analyzing the gap: Top displaying data, deciding and combining best work practices, Balance Score Card Technique, Value Stream Mapping, validation, recommendations etc

**6 Hours**

#### UNIT - 4

##### **BENCHMARKING:**

Definition, mission and objectives, managing benchmarking process, training and code of conduct, future scope and benchmarking process. What to benchmark: concept of step zero, priorities, business processes – linking to goals etc, investigation, documentation, performance measures, improving

business processes. Whom to benchmarks: Developing candidate list, systematic search, refining the initial list. **7 Hours**

## **PART - B**

### **UNIT - 5**

**DEFINITION OF REENGINEERING:** Importance of 3Cs-customers takes charges, competition intensifies, and change becomes constant. Definition of Business Process Reengineering – fundamentals rethinking, radical redesign, and dramatic improvement.

**6 Hours**

### **UNIT - 6**

Rethinking business process, new world of and enabling role of information technology.

### **QUALITY MANAGEMENT SYSTEMS:**

ISO 9000-2000, IS 14000, Frame Work for Business Excellence - Malcolm Baldrige Award, Deming's Award

**7 Hours**

### **UNIT - 7**

**SIX SIGMA:** The Basics, The core of Six Sigma(DMAIC), design for Six Sigma, DFSS and the customer, Quality time and the Bottom line , core of DFSS-IDOV method , DFSS Metrics, DFSS Infrastructure –People and resources, Implementing DFSS

**7 Hours**

### **UNIT - 8**

#### **ACTIVITY BASED MANAGEMENT (ABM):**

Introduction, Traditional Cost Systems, Activity Based activity Based Costing, Activity Based Management, ABM Implementation, Case Study.

Introduction to Theory Of Constraints (TOC)

**5 Hours**

#### **TEXT BOOKS:**

1. **World Class Manufacturing- A Strategic Perspective** - Sahay B S, Saxena K B C, Ashish Kumar - MacMillan India Ltd - ISBN 0333-93-4741. (unit 1 & 2)
2. **Finding and Implementing Best Practices- Business Process Benchmarking** -Champ, Robert C. - Vision Books, New Delhi – 2008.(unit 3 & 4)
3. **Reengineering the corporation - A Manifesto for Business revolution** - Hammer, Michael and James Champy - Nicholas Brealey Publishing , London.- 1993(unit 5 & 6)
4. **Six sigma for Managers-** Greg Brue - TMH - ISBN- 0-07-048639-5 -2002.(unit 7)

#### **REFERENCE BOOKS:**

1. **Design for Six Sigma** –Grege – TMH - ISBN 0-07-058120. – 2003.
2. **Design for Six Sigma Technology and Product Development** – Creveling -Pearson Education – 2008.
3. **Total Quality Management** -Dale H. Besterfield, carol Besterfield-Minchna, glen H Besterfield and Mary Besterfield scare - Pearson education - 3<sup>rd</sup> edition - ISBN 81-297-0260-6 (Part of Unit 6 )
4. **Total Quality Management** - Kesavan R - I K International Publishing house Pvt. Ltd - 2008

### MANAGEMENT INFORMATION SYSTEMS

Subject Code	: 10IP 765	IA Marks	: 25
No. of Lecture Hours./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours.	: 52	Exam Marks	: 100

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#### PART - A

##### UNIT - 1

**FUNDAMENTALS OF INFORMATION SYSTEMS:** Information systems in business, fundamentals of information systems solving business problems with information systems.

**6 Hours**

##### UNIT - 2

**INFORMATION SYSTEMS FOR BUSINESS OPERATIONS:** Business information systems, Transaction processing systems, management, information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

**7 Hours**

##### UNIT - 3

**ISSUES IN MANAGING INFORMATION TECHNOLOGY:** Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology.

**7 Hours**

##### UNIT - 4

**INTRODUCTION TO e-BUSINESS:** e-commerce frame work, Media convergence, Consumer applications, Organization applications.

**6 Hours**

#### PART - B

##### UNIT - 5

**e-BUSINESS MODEL:** Architectural frame work for e-commerce, Application services and transaction

Models – B2C Transactions, B2B Transactions, Intra-Organisational Transactions.

**6 Hours**

**UNIT - 6**

**e -BUSINESS MODEL:** WWW Architecture: Client server structure of the web, e-Commerce architecture, Technology behind the web.

**6 Hours**

**UNIT - 7**

**CONSUMER-ORIENTED e-COMMERCE:** Consumer oriented Application: Finance and Home Banking, Home shopping, Home Entertainment, Mercantile Process Models, Consumers perspective, Merchants perspective.

**7 Hours**

**UNIT - 8**

**ELECTRONICS DATA INTERCHANGE (EDI):** EDI Concepts, Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI.

**7 Hours**

**TEXT BOOKS:**

1. **Management Information systems** - managing information technology in the internet worked enterprise - jams. A O'Brien - Tata McGraw Hill publishing company limited - 2002.
2. **Management Information Systems** - Laaudon & Laudon – PHI - ISBN 81-203-1282-1.1998.

**REFERENCE BOOKS:**

1. **Management Information systems** - S. Sadogopan. - PHI - 1998Edn. ISBN 81-203-1180-9.
2. **Information systems for modern management** - G.R. Murdick - PHI - 2<sup>nd</sup> Edition.

## MACHINE TOOL DESIGN

Subject Code	: 10IP766	IA Marks	: 25
No. of Lecture Hours./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours.	: 52	Exam Marks	: 100

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### 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.

#### UNIT -2

**Machine Tool Drives and Mechanisms:** Working and auxiliary motion, Drives – Electric drives, Hydraulic transmission, Kinematic structure, Regulation of speed and feeds, stepped regulation, standardization of speed and feed, Stepless regulation of speeds and feeds. **7 Hours**

#### UNIT - 3

**Cutting Force Analysis and Power Requirement:** Turning, Milling, Drilling, Shaping and Broaching operation with simple problems, and General requirements of machine tools – Centre lathe, Milling machine. **6 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. **7 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 **7 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. **7 Hours**

#### **UNIT - 7**

**Dynamics of Machine Tools:** Concept of dynamic cutting process, Physical causes of chatter and vibrations, Types of Chatter, chatter vibration in Lathe, Drilling machine, Grinding machine and Milling machine, Different methods for avoiding machine tool chatter and vibration. **6 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 – Selective Mechanical control – Ergonomic consideration and compatibility – Automatic control system – Electric Hydraulic and pneumatic systems. **6 Hours**

#### **TEXT BOOKS:**

1. **Machine Tool Design** - N. K. Mehta – Tata McGraw Hill - 2001.
2. **Principles of Machine tools** - Sen and Bhattacharya – Oxford IBM Publishing - 2000.

#### **REFERENCE BOOKS:**

1. **Machine Tool Design Volume** - N. Acharkan – MIR Publications - II and III - 2000.
2. **Design of Machine Tools** - S. K. Basu and D. K. Pal – 2000.

## VIII SEMESTER

### SUPPLY CHAIN MANAGEMENT

Subject Code	: 10IP/IM81	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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#### PART - A

##### UNIT - 1

**BUILDING A STRATEGIC FRAME WORK TO ANALYSE SUPPLY CHAINS:** Supply chain stages and decision phase, process view of a supply chain. Supply chain flows. Examples of supply chains. Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit, Case discussions.

**7 Hours**

##### UNIT - 2

**DESIGNING THE SUPPLY CHAIN NETWORK:** Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.

**6 Hours**

##### UNIT - 3

**FACILITY LOCATION AND NETWORK DESIGN:** Models for facility location and capacity allocation. Impact of uncertainty on SCN – discounted cash flow analysis, evaluating network design decisions using decision trees. Analytical problems.

**6 Hours**

##### UNIT - 4

**PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN:** Review of inventory concepts. Trade promotions, Managing multi-echelon cycle inventory, safety inventory determination. Impact of supply

uncertainty aggregation and replenishment policies on safety inventory. Optimum level of product availability; importance factors. Managerial levers to improve supply chain profitability.

**7 Hours**

## **PART - B**

### **UNIT - 5**

**SOURCING, TRANSPORTATION AND PRICING PRODUCTS:** Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration.

**6 Hours**

### **UNIT - 6**

**SOURCING, TRANSPORTATION AND PRICING PRODUCTS:** Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade-off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role of Revenue Management in the supply chain, Revenue management for: Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts.

**7 Hours**

### **UNIT - 7**

**COORDINATION AND TECHNOLOGY IN THE SUPPLY CHAIN:** Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships.

**6 Hours**

### **UNIT - 8**

**COORDINATION AND TECHNOLOGY IN THE SUPPLY CHAIN:** The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of e-business in a supply chain, The e-business framework, e-business in practice. Case discussion.

**4 Hours**

**EMERGING CONCEPTS:** Reverse Logistics, Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six Sigma in Supply Chains.

**3 Hours**

### **SUGGESTED TEXT BOOK:**

1. **Supply Chain Management – Strategy, Planning & Operation** - Sunil Chopra & Peter Meindl - Pearson Education Asia - ISBN: 81-7808-272-1. – 2001.

### **REFERENCE BOOKS:**

1. **Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems** - Robert B Handfield, Ernest L Nichols, Jr. - Pearson Education Inc - ISBN: 81-297-0113-8. - 2002.
2. **Modelling the Supply Chain** -Jeremy F Shapiro, Duxbury - Thomson Learning – ISBN 0-534-37363. -2002.
3. **Designing & Managing the Supply Chain** -David Simchi Levi, Philip Kaminsky & Edith Simchi Levi - Mc Graw Hill.
4. **Supply Chain and Logistics Management** – Upendra Kachuru

### FACILITIES PLANNING AND DESIGN

Subject Code	: 10IP/IM82	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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#### PART - A

##### UNIT - 1

**PLANT LOCATION:** Factors influencing plant location, Theories of plant location and location economics. Plant layout-Objectives of plant layout, Principles of plant layout, types of plant layout, their merits and demerits, facilities design function: Objectives, Types of Layout Problems.

**7 Hours**

##### UNIT - 2

**MATERIAL HANDLING:** Objectives and principles of Material handling, Unit load concept, classification of material handling equipment based systems, different types of material handling equipments

**6 Hours**

##### UNIT - 3

**PLANT DESIGN:** Layout procedures: Immer, Nadler, Muther, Apple James and Reed's approaches, systematic layout planning, activity relationship chart, relationship Diagram, Space relationship diagram to plant layout

**7 Hours**

##### UNIT - 4

**COMPUTERIZED LAYOUT PLANNING:** CRAFT, COFAD, PLANET, CORELAP, ALDEP

**6 Hours**

#### PART - B

##### UNIT - 5

**SPACE DETERMINATION AND AREA ALLOCATION:** Factors for consideration in space planning, receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions, Establishing total space requirement, area allocation factors to be considered, expansion, flexibility,

aisles column, area allocation procedure, the plot plan. Sequence demand, Straight line and non directional methods

**7 Hours**

**UNIT - 6**

**CONSTRUCTION OF THE LAYOUT:** Methods of constructing the layout, evaluation of layout, efficiency indices, presenting layout to management

**3 Hours**

**LOCATION MODELS:** Single and Multi facility location models, Location allocation problems – quadratic assignment problems.

**3 Hours**

**UNIT - 7**

**QUANTITATIVE APPROACHES TO FACILITIES PLANNING:** Deterministic models, single and multi facility location models, Location allocation problems – quadratic assignment problem, Warehouse layout models, plant location problems.

**6 Hours**

**UNIT - 8**

**LAYOUT MODELS:** Warehouse Layout Models, Waiting line models, Storage models – simple problems, Evaluation, selection and implementation of facilities plan

**6 Hours**

**TEXT BOOKS:**

1. **Plant layout and material handling** - James M Apple - John Wiley India Pvt Ltd - 2<sup>nd</sup> Edition.
2. **Facility Layout and location** - Francies R.L and White J A - Mc Graw Hill - 2<sup>nd</sup> Edition.

**REFERENCE BOOKS:**

1. **Facilities Design** -Sunderesh Heragu - PWS Publishing Company-ISBN-0-534-95183.
2. **Plant Layout Design** -James M Moore - Mac Millon Co. -1962 – LCCCN61- 5204
3. **Facility Planning** - Tompkins White - Wiley India Pvt Ltd - 3<sup>rd</sup> Edition.

**Elective IV (Group D)**

**ORGANIZATIONAL BEHAVIOUR**

Subject Code	: 10IP/IM 831	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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**PART - A**

**UNIT - 1**

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

**4 Hours**

**THE INDIVIDUAL:** Foundation of individual behaviour, Ability

**2 Hours**

**UNIT - 2**

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

**6 Hours**

**UNIT - 3**

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

**6 Hours**

**UNIT - 4**

**VALUES AND ATTITUDES:** Definition – values, Attitudes: Types of values, job satisfaction, job involvement, professional Ethics, Organizational commitment, cognitive dissonance.

**6 Hours**

**PART - B**

**UNIT - 5**

**MOTIVATION:** Maslow's Hierarchy of Needs, Mc. Gregor's theory X and Y, Herzberg's motivation Hygiene theory, David Mc Cleland three needs theory, Victor Vroom's expectancy theory of motivation.

**7 Hours**

**UNIT - 6**

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

**CONFLICT MANAGEMENT:** Definition of conflict, functional and disfunctional conflict, stages of conflict process.

**7 Hours**

**UNIT - 7**

**LEADER SHIP:** Definition, Behavioural theories – Blake and Mounon managerial grid, Contingency theories – Hersey - Blanchard's situational theory, Leadership styles – characteristics, Transactional, transformation leaders.

**8 Hours**

**UNIT - 8**

**THE ORGANIZATION:** Mechanistic and Organic structures, Minitberg's basic elements of organization, Organizational Desings and Employee behaviour, organization development – quality of work life (QWL), Team building.

**6 Hours**

**TEXT BOOKS:**

1. **Organizational Behaviour** - Stephen P Robbins -Pearson Education Publications - 9<sup>th</sup> Edn, ISBN-81-7808-561-5.
2. **Organizational Behaviour** – Schermerhorn - Wiley India Pvt Ltd - 9<sup>th</sup> Edn.
3. **Management of Organizational Behaviours** - Paul Henry and Kenneth H. Blanchard - Prentice Hall of India - 1996.
4. **Organizational Behaviour** – Fred Luthans - Mc Graw Hill International Edition - 9<sup>th</sup> Edn., ISBN-0-07- 20412-1

**REFERENCE BOOKS:**

1. **Organisation Behaviour** – Hellriegel, Srocum and woodman, Thompson Learning - Prentice Hall India - 9<sup>th</sup> Edition, 2001.
2. **Organizational Behaviour** – VSP Rao and others - Konark Publishers - 2002.

## KNOWLEDGE MANAGEMENT

Subject Code	: 10IP/IM 832	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**ESSENTIALS OF COMPUTING:** Birth of Computing, Evolution of Modern Computing, What is data?, Information Processing, Information Technologies, Evolution of Information Systems, Evolution of Information Systems, Implementation of Organization, Organizational Learning, Traditional Organizational Information Systems, Moderns Organizational Information System, Deployment of Information System.

**6 Hours**

#### UNIT - 2

**QUALITY, RE-ENGINEERING METHODOLOGIES AND BUSINESS PARADIGMS:** Introduction, Industrial Evolution, Quality Methodologies, Control charts, Lot sampling, Process Capability, Value Analysis, Key Characteristics, Total Quality Management – Basic Principles, TQM Structure, Hoshin, TQM Tools, Six Sigma, Re-engineering Methodologies, Business Process Re-engineering, Artificial Intelligence – beginning, Advancements, Approaches, Neural Networks, Expert Systems, Branches of AI, Emerging Business Paradigms – e-business, classification, system, anwendungen, Produkte in der Datenverarbeitung, e-business and knowledge Management, Knowledge Management – The information processing paradigm, Knowledge organization.

**8 Hours**

#### UNIT - 3

**KNOWLEDGE MANAGEMENT – AN INSIGHT:** Knowledge Management – Evolution, why now, Limitation of Existing initiatives, value of knowledge, Minimize effort duplication, sharing of best practices, enhanced innovation, imperatives, Organizational knowledge management –

The need, key benefits, key benefits parameters, Organizational benefits, core implementation areas, organizational performance, implementation responsibilities, core groups involved, organization barriers, key elements, Organizational knowledge management.

**6 Hours**

#### **UNIT - 4**

**KNOWLEDGE MANAGEMENT – AN INSIGHT:** The Drivers, Knowledge based driver, technology drivers, Intra – organizational drivers, process drivers, economic drivers, Knowledge Management – Future, Global knowledge economy – characteristics of the knowledge economy, policy implications, business implications, What is knowledge Management, Organizational Knowledge Management Approaches – management structure, funding, Organizational culture and enablers, Technology infrastructure, Organizational knowledge management strategies, Components and function, Learning organization – Knowledge sources, focus on products and processes, Documentation, knowledge dissemination, Organisational learning, value-chaining, skill development.

**6 Hours**

### **PART - B**

#### **UNIT - 5**

**ESSENTIALS OF KNOWLEDGE MANAGEMENT:** Introduction, What is Knowledge? – Data, Information and Knowledge, Wisdom, basic Types of Knowledge, Organizational Knowledge management – types, Capital, classification, Knowledge life cycle, Sources, processes, Knowledge Conversion – Organizational knowledge progression, Organizational knowledge management – technology enablers, organizational intellectual / human capital organizational meta knowledge.

**6 Hours**

#### **UNIT - 6**

**KNOWLEDGE MANAGEMENT TECHNIQUES, SYSTEMS AND TOOLS:** Introduction, Organizational Knowledge creation – Knowledge networks, Organizational knowledge mapping techniques, core implementation issues, usage, Organizational knowledge spiral, Organizational Knowledge / capture – Implementation methodology, Knowledge Acquisition Tools, Organizational Knowledge indexing, processing, Document Management System, Database Management Systems Data warehouse, Knowledge Analysis – Data mining, On-line analytical processing, Organizational knowledge dissemination.

**6 Hours**

#### **UNIT - 7**

**ORGANIZATION KNOWLEDGE MANAGEMENT ARCHITECTURE AND IMPLEMENTATION STRATEGIES:** Introduction, Developing a KM Framework, Implementation Phases, Architectural Components, KM Systems Requirements, Tools, KM Systems Components – Implementation Strategies – Awakening phase, Actionable

phase, Implementation phase, maintenance and measurement phase, Organizational Organic capabilities architecture – business, Information, Data, Systems, Computer, Layered Knowledge. Organizational knowledge management architecture – key considerations, Organizational knowledge Repositories – structure, Life cycle, Organizational knowledge refineries, KM applications – Integrative application Interactive application, knowledge processing applicants management, composite application, organizational KM context, Organizational platforms – Enterprises information portals, competitive advantages, enterprise knowledge portal, characteristics, Organizational knowledge measurement framework - Awakening stage, actionable phase, implementation phase, Support phase, Organizational deployment, Organisational knowledge Measurement Techniques – Intangible Assets measurement, intangible Assets Monitor, balanced Scorecard, organizational implementation barriers.

**8 Hours**

#### **UNIT - 8**

**K-CAREERS:** Introduction, Knowledge Management roles, New organizational roles, Organisational k-role classification, Knowledge management job opportunities – knowledge job approach, generic role requirements, role description, Knowledge architect, Knowledge strategist, Knowledge manager, Research analyst / manager, knowledge management consultant, media specialist, senior market intelligence librarian, ontologies / knowledge engineer, knowledge management specialist, intranet developer / knowledge management content developer, knowledge management director, director of ontologies, ontologist (biological domain), natural language processing specialist (medical/biomedical), knowledge development manager.

**6 Hours**

#### **TEXT BOOK:**

1. **Knowledge Management** - Sudhir Warier - Vikas Publishing House - ISBN: 81-259-1363-7.

#### **REFERENCE BOOK:**

1. **Hand book on Knowledge Management** - C W Holsapple, Springer - 2003 Porter M.
2. **Management Toolkit: Practical Techniques for Building a Knowledge Management System** - Prentice Hall – 1999.
3. **An investigation of Knowledge Management characteristics** - Joshi K - exington, KY – 1998.

## DESIGN OF EXPERIMENTS

Subject Code	: 10IP/IM 833	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**INTRODUCTION:** History of quality engineering: Japan versus U.S. track records. Taguchi Approach to Quality: Definition of quality. loss function, Off-line and On-line quality control. Taguchi's quality philosophy.

**6 Hours**

#### UNIT - 2

**BASIC DESIGNS:** Completely Randomised Design, Randomised Block Design, Latin Square Designs, one way analysis of variance and two way analysis of variance.

**6 Hours**

#### UNIT - 3

**FACTORIAL EXPERIMENTATION -TWO LEVELS:** Full Factorial Designs: Experimentation as a learning process. Traditional scientific experiments. Two-factor design. Four-factor design, Replicating experiments. Factor interactions.

**6 Hours**

#### UNIT - 4

**FACTORIAL EXPERIMENTATION-EIGHT AND SIXTEEN RUN EXPERIMENTS:** Fractional factorial designs based on eight-run experiments, Folding over an eight run and sixteen – run experiment

**6 Hours**

### PART - B

#### UNIT - 5

**CONSTRUCTING ORTHOGONAL ARRAYS:** Counting degrees of freedom, selecting a standard orthogonal array, dummy level technique and

compound factor method. Linear graphs and interaction assignment. Modification of linear graphs, column merging method, branching design. Strategy for constructing an orthogonal array. Comparison with the classical statistical experiment design.

**7 Hours**

**UNIT - 6**

**STEPS IN ROBUST DESIGN:** Case study discussion. Noise factors and testing conditions. Quality characteristics and objective functions. Control factors and their levels. Matrix experiment and data analysis plan. Conducting the matrix experiment, data analysis, verification experiment and future plan.

**7 Hours**

**UNIT - 7**

**SIGNAL-TO-NOISE RATIO FOR STATIC PROBLEMS:** Evaluation of sensitivity to noise. S/N ratios for Smaller-the-better, Larger-the-better, Nominal-the-best and Asymmetric Cases

**7 Hours**

**UNIT - 8**

**SIGNAL-TO-NOISE RATIO FOR DYNAMIC PROBLEMS:** S/N ratios for Continuous-continuous, continuous-digital, digital-continuous, digital-digital cases. Introduction to Taguchi Inner and Outer Arrays

**7 Hours**

**TEXTBOOKS:**

1. **Quality Engineering Using Robust Design** - Madhav S. Phadke - Prentice Hall PTR, Englewood Cliffs, New Jersey 07632.
2. **Design of Experiments** - D.C. Montgomery - John Wiley and Sons - 2002.

**REFERENCE BOOK:**

1. **Designing for Quality - an Introduction Best of Taghuchi and Western Methods or Statistical Experimental Design** - Robert H. Lochner and Joseph E. Matar - Chapman and Hall Madras - 2<sup>nd</sup> edition.

## ADVANCED OPERATIONS RESEARCH

Subject Code	: 10IP/IM 834	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**LINEAR PROGRAMMING:** Two phase simplex method, Revised simplex algorithm and its applications.

**6 Hours**

#### UNIT - 2

**ADVANCED LINEAR PROGRAMMING:** Sensitivity analysis, Integer Programming –graphical technique and Gomory’s technique.

**7 Hours**

#### UNIT - 3

**SPECIAL TYPE OF LPP:** Solutions of Assignment and Travelling salesman problems using Branch and Bound Approach.

**GOAL PROGRAMMING:** Introduction and simple formulation.

**6 Hours**

#### UNIT - 4

**NON-LINEAR PROGRAMMING:** Kuhn – Tucker conditions, QPP - solution using Wolfes algorithm

**6 Hours**

### PART - B

#### UNIT - 5

**DYNAMIC PROGRAMMING:** Characteristics and DP model, Computational procedure -Simple problems only

**6 Hours**

#### UNIT - 6

**ADVANCED CPM TECHNIQUES:** CPM - Elements of crashing, least cost project scheduling. Flow in networks; Determination of shortest route, Determination of Maximum flow through the networks, Minimal Spanning Tree. Resource Allocation for optimal utilisation of resources

**8 Hours**

**UNIT - 7**

**QUEING THEORY:** M/Ek/1, M/D/1, M/M/C and MG1

**6 Hours**

**UNIT - 8**

**MARKOV CHAINS:** Discrete Stochastic Process, Markovian process, Stationary Markov chains, Markov diagrams, Ergodic and Absorbing Markov chains, Steady State probabilities, stochastic matrix transition, matrix and their applications.

**7 Hours**

**TEXT BOOKS:**

1. **Introduction to Operation Research** -Taha H A - Prentice Hall of India - 6<sup>th</sup> edition, 1999.
2. **Principles of Operations Research theory and Practice** -Philips, Ravindram and Soleberg– Theory and Practice - Wiley India Pvt Ltd.

**REFERENCE BOOKS:**

1. **Introduction to Operation Research** -Hiller and Libermann - McGraw Hill - 5<sup>th</sup> edn.
2. **Operations Research** -S.D. Sharma - Kedarnath, Ramnath & Co - 1996
3. **Operations Research Theory and Application** - J K Sharma - Pearson Education Pvt Ltd - 2<sup>nd</sup> Edn - ISBN-0333-92394-4.

## DATA BASE MANAGEMENT SYSTEM

Subject Code	: 10IP/IM 835	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT - 1

**DATABASES AND DATABASE USERS:** Introduction, characteristics of data base approach, intended uses of a DBMS, advantages and implication of database approach.

**2 Hours**

**DATABASE SYSTEMS CONCEPTS AND ARCHITECTURE:** Data models, Schemas and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of data base management systems.

**5 Hours**

#### UNIT - 2

**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 diagrams

**6 Hours**

#### UNIT - 3

**RECORD STORAGE AND PRIMARY FILE ORGANIZATION:** Secondary storage devices, buffering of blocks, placing file records on disk, operations on files, heap files and sorted files, hashing techniques.

**6 Hours**

#### UNIT - 4

**INDEX STRUCTURE OF FILES:** Single-level and multilevel ordered indexes, dynamic multi level indices using B-trees and B+ trees.

## PART - B

## UNIT - 5

**RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA:** Brief discussion on **Codd** rules, relational model concepts, constraints and schemas. Update operation on relations, basic and additional relational algebra operations and queries in relational algebra.

**Structured Query Language (SQL):** Data definition in SQL2. Basic and complex queries in SQL. Insert, delete, update statements, and views in SQL, embedded SQL.

9 Hours

## UNIT - 6

**DATABASE DESIGN:** Design guidelines for relational schemes, functional Dependencies, normalization -1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> normal forms. Database design process, factors influencing physical database design guidelines and guidelines for relational systems.

6 Hours

## UNIT - 7

**SYSTEM IMPLEMENTATION:** System cat log for RDBMS, transaction processing and system concepts, properties of transactions, brief discussion on concurrency, control and recovery techniques, database security and authorization.

6 Hours

## UNIT - 8

**BRIEF DISCUSSION ON:** Distributed databases, Objected oriented databases, next generation databases and interfacing with other technologies.

6 Hours

## TEXT BOOKS:

1. **Fundamentals of database systems** -Ramez Elmasri and Shamkanth B. Navathe - Addison Wesley Publishing Company - 6<sup>th</sup> Edition.
2. **Database Management System** - Raghu Ramakrishnan and Johannes Gehrke - TATA McGraw Hill - 3<sup>rd</sup> Edition - ISBN 0-07-1231511

## REFERENCE BOOKS:

1. **Database Management Design** - Gary W. Hansen and James V. Hanesn - PHI Pvt. Ltd. - 2<sup>nd</sup> Edition.

## ADVANCED JOINING PROCESSES & NDT

Subject Code	: 10IP 836	IA Marks	: 25
No. of Lecture Hours./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours.	: 52	Exam Marks	: 100

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### PART - A

#### UNIT –I

**METAL SURFACING AND SPRAYING:** Introduction, Types of wear, types of surfacing, surfacing methods, selection of surfacing process, selection of a surfacing material, surfacing procedure, applications. Introduction to metal spraying, process steps, metallizing materials and their selection. Coating characteristics and evaluation, Applications.

**7 Hours**

#### UNIT -II

**WELDING IN SPACE AND LOW GRAVITY ENVIRONMENT:** Need, Application of electron beam welding, laser beam welding, gas tungsten arc welding with advantage and limitations, metallurgy of low gravity welds.

**6 Hours**

#### UNIT –III

**UNDERWATER WELDING PROCESSES:** Introduction, problems encountered in underwater welding, types of underwater welding, characteristics of a good underwater welding process, methods of underwater welding, Applications.

**6 Hours**

#### UNIT -IV

**WELDING OF PLASTICS AND COMPOSITES:** Principle of welding plastics, common weldable plastics, welding joint design, surface preparation, plastic welding processes, principle of operation, equipment required, Advantages, Applications.

Introduction to Composites, methods preferred welding composites. Induction welding, ultrasonic welding, GTAW, Magnetically Impelled Arc Butt Welding (MIAB) **7 Hours**

#### **PART – B**

##### **UNIT -V**

**INTRODUCTION TO ND TESTING:** Selection of ND methods, visual inspection, leaks testing Liquid penetration inspection, its advantages and limitations. Magnetic Particle Inspection: Methods of generating magnetic fields – types of magnetic particles and suspension liquids – steps in inspection – application and limitations. Eddy Current Inspection: Principles, operation variables, procedure, inspection coils, and detectable discounts by the method. **7 Hours**

##### **UNIT -VII**

**ULTRA SONIC INSPECTION:** Basic equipment characteristics of ultra sonic waves, variables in inspection, inspection methods – pulse echo A, B, C, scans, transmission, resonance techniques, transducer elements, couplets, search units, contact types and immersion types. **6 Hours**

##### **UNIT -VIII**

**RADIOGRAPHIC INSPECTION:** Principles, radiation sources, x-rays and gamma rays: x-rays tubes, radio graphic films, screens and filters, image intensifiers, technique charts, industrial radiography, electro-radiography, image quality, radiographic sensitivity, electron neutron radiography. **7 Hours**

##### **UNIT -VIII**

**INDUSTRIAL COMPUTED TOMOGRAPHY:** Basic principles, capabilities, and comparison with other NDE methods – application of ICT. Thermal inspection principles, equipment inspection methods applications. **6 Hours**

#### **TEXT BOOKS**

1. **Welding processes and Technology** - Dr. R. S. Parmar., – Khanna Publications, 2<sup>nd</sup> Edition.
2. **A Text book of welding Technology** - O.P. Khanna.,– Dhanapat Rai and Sons
3. **Non-destructive testing-** McGonnagle J.J.,– garden and reach, Newyork (Latest edition)

#### **REFERENCE BOOKS**

1. **Non-destructive evaluation and quality control** - Vol.17 of Metals Handbook, 9<sup>th</sup> edition – Asia internal 1989.
2. **The testing inspection of Engg. Materials** - Davis H.E., Troxell G.E., Wiskovil C.T., McGraw Hill (Latest Edition).
3. **ASM Handbook** – Welding, brazing and soldering, Vol. 6, 2005

### Elective V (Group E)

#### ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

Subject Code	: 10IP/IM841	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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#### PART - A

##### UNIT - 1

**ARTIFICIAL INTELLIGENCE:** Introduction, definition, underlying assumption, important of AI, AI & related fields State space representations, defining a problem, production systems and its characteristic, search and control strategies – Introduction, preliminary concepts, examples of Search problems.

**6 Hours**

##### UNIT - 2

**UNIFORMED OR PRELIMINARY CONCEPTS:** Examples of search problems, Uniformed or Blind Search, Informed Search, Or Graphs, Heuristic Search techniques – Generate and Test, Hill climbing, best first search, problem reduction, constraint satisfaction, Means – Ends Analysis.

**8 Hours**

##### UNIT - 3

**KNOWLEDGE REPRESENTATION ISSUES:** Representations and Mapping, Approaches, Issues in Kr, Types of Knowledge procedural Vs Declarative, Logic programming, Forward Vs Backward reasoning, Matching, Non monotonic reasoning and it logic.

**6 Hours**

##### UNIT - 4

**USE OF PREDICATE LOGIC:** Representing simple facts, Instance and is a relationships, Syntax and Semantics for Propositional logic, FOPL, and properties of Wffs, conversion to causal form, Resolution, Natural deduction

**6 Hours**

**PART - B**

**UNIT - 5**

**STATISTICAL AND PROBABILISTIC REASONING:** Symbolic reasoning under uncertainly, Probability and Bayes' theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster – Shafer Theory, Fuzzy Logic

**8 Hours**

**UNIT - 6**

**EXPERT SYSTEMS:** Introduction, Structure and uses, Representing and using domain knowledge, Expert system shells. Pattern recognition, Introduction, Recognition and classification process, Learning classification Patterns, Recognizing and Understanding Speech.

**6 Hours**

**UNIT - 7**

**INTRODUCTION TO KNOWLEDGE ACUQISTION:** Types of learning, General learning model, and performance measures.

**6 Hours**

**UNIT - 8**

**TYPICAL EXPERT SYSTEMS:** MYCIN, Variants of MYCIN, PROSPECTOR, DENDRAL, PUFF etc.

**INTRODUCTION TO MACHINE LEARNING:** Perceptons, Checker Playing examples, Learning, Automata, Genertic Algorithms, Intelligent Editors.

**6 Hours**

**TEXT BOOKS:**

1. **Artificial intelligence** – Elaine Rich & Kevin Knight - M/H - 1983.
2. **Artificial intelligence in business, Science & Industry** – Wendry B.Ranch - Ph - Vol II application, 1985.
3. **A.guide to expert systems** – waterman, D.A., Addison – wesley inc. - 1986.
4. **Building expert systems** – Hayes, Roth, Waterman, D.A (ed) – AW - 1983.
5. **Designing expert systems** – weis, S.M. and Kulliknowske - London Champion Hull - 1984.

## JUST IN TIME MANUFACTURING

Subject Code	: 10IP/IM 842	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

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### PART – A

#### UNIT - 1

**JIT-AN INTRODUCTION:** Speed of JIT movement, the new production system research association of Japan, some definitions of JIT, core Japanese practices of JIT, creating continuous manufacture, enabling JIT to occur, basic element of JIT, benefits of JIT.

**6 Hours**

#### UNIT - 2

**MODERN PRODUCTION SYSTEM:** Key feature of Toyota's production system, basic framework of Toyota production system. **KANBAN SYSTEM** – other types of kanban's, kanban rules, adapting to fluctuations in demand through kanban, whirligig, determining the number of kanban's in Toyota production system, detailed kanban system example, supplier kanban and the sequence schedule for use by suppliers.

**6 Hours**

#### UNIT - 3

**PRODUCTION SMOOTHING IN TOYOTA PRODUCTION SYSTEM:** production planning, production smoothing, adaptability to demand fluctuations, sequencing method for the mixed model assembly line to realize smoothed production, Criticism of Toyota production system by the communist party of Japan. EDP system for support of the Toyota Production system. Shortening lead time in Toyota Production system – reducing the

setup time. Automation in Toyota production system, some comparisons with other manufacturers.

**6 Hours**

**UNIT - 4**

**GLOBAL IMPLEMENTATION OF JIT:** JIT in automotive industry, JIT in electronics, computer, telecommunication and instrumentation, JIT in process type industry, JIT in seasonal demand industry, other manufacturing industries, JIT in service and administrative operations, conclusion.

**6 Hours**

**PART - B**

**UNIT - 5**

**JIT IMPLEMENTATION SURVEYS:** JIT implementation in US manufacturing firms-analysis of survey results, just in time manufacturing industries, just in time production in West Germany, just in time production in Hong Kong electronics industry, conclusion.

**6 Hours**

**UNIT - 6**

**DESIGN, DEVELOPMENT AND MANAGEMENT OF JIT MANUFACTURING SYSTEMS:** plant configurations and flow analysis for JIT manufacturing, comparison of JIT's "demand pull" system with conventional "push type" planning and control systems, quality management system for JIT, product design for JIT human resource management in JIT, flexible workforce system at Toyota, creation and maintenance of teams for JIT, union organization and conduct of industrial relations in JIT, interface of JIT with advanced manufacturing technology, assessing performance in JIT manufacturing systems, product costing information systems in JIT manufacturing, an example of overhead allocation in JIT, potential for developing countries, potential for small manufacturing.

**9 Hours**

**UNIT - 7**

**SUPPLY MANAGEMENT FOR JIT:** JIT purchasing-the Japanese way, some studies in JIT purchasing, experience of implementation organizations, surveys of JIT purchasing, buyer-seller relationship in JIT purchasing, Quality certification of suppliers in JIT purchasing, some problems in implementation of JIT purchasing, reduction freight costs in JIT purchasing, monitoring supplier performance for JIT purchasing, audit in JIT purchasing, implementation of JIT to international sourcing, frequency of shipments, inventory policy, supplier reaction capability, quality, communication sole sourcing, delivery performance and supplier flexibility, conclusion.

**7 Hours**

**UNIT - 8**

**FRAMEWORK FOR IMPLEMENTATION OF JIT:** Implementation risk, risks Due to inappropriate understanding of JIT, risks due to technical, operational and people problems, risks associated with kanban system, some important activities to be performed during implementation, steps in implementation, a project work to approach to implementation, conclusion.

**TEXT BOOKS:**

1. **Just In Time Manufacturing** - M.G. Korgaonker - Macmillan India Ltd. - 1992.
2. **Japanese Manufacturing Techniques** - Richard J. Schonberger - The Free Press – Macmillan Pub. Co., Inc. New York - 1988.

**AUTOMATION IN MANUFACTURE**

Subject Code	: 10IP/IM843	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

**PART - A****UNIT- 1**

**INTRODUCTION:** Definition of Automation, Reasons for Automation, Arguments for and against Automation, Manufacturing industries, Types of Productions, Functions in Manufacturing, Organization & Information processing in Manufacturing. **6 Hours**

**UNIT- 2**

**PRODUCTION CONCEPTS & MATHEMATICAL MODELS:** Manufacturing Load Time(MLT), Components of operation time, Capacity, Utilization, Availability, Work in Process(WIP), Automation Strategies. (Including numericals) **7 Hours**

**UNIT- 3**

**PRODUCTION COST ANALYSIS METHODS OF EVALUATING INVESTMENT ALTERNATIVES:** Costs in Manufacturing, Break-even Analysis, Unit Cost of Production, Cost of Manufacturing Lead Time & Work-in-process, Other Difficult-to-quantify Factors. **7 Hours**

**UNIT- 4**

**DETROIT-TYPE OF AUTOMATION:** Automated Flow Lines, Methods of Work part Transport, Transfer Mechanism, Buffer Storage, Control

Functions, Automation for Machining Operations, Design & Fabrication Considerations. **6 Hours**

## **PART - B**

### **UNIT- 5**

**ANALYSIS OF AUTOMATED FLOW LINES:** General Terminology & Analysis, Analysis of Transfer Lines without storage, Partial Automation, Automated Flow Lines with storage buffers, Computer simulation of Automated Flow Lines. (Including Numericals). **7 Hours**

### **UNIT - 6**

**ANALYSIS OF ASSEMBLY SYSTEMS & LINE BALANCING:** The assembly process, Assembly Systems, Manual Assembly Lines, Line balancing problem, Methods of line balancing, Computerized Line Balancing Methods, Other ways to improve line balancing, Flexible Manual Assembly Lines, Design for automated assembly, Types of automated assembly systems, Parts feeding devices, Analysis of multi station assembly machines, Analysis of single station assembly machine. (Including Numericals). **7Hours**

### **UNIT- 7**

**AUTOMATED MATERIAL HANDLING AND STORAGE SYSTEMS:** The Materials Handling Function, Types of material handling equipments, Analysis for Material Handling Systems, Design of systems, Conveyor systems, Automated guided vehicle systems, Storage system performance, Automated storage & retrieval system, Carousal storage system, Work in process storage, Interfacing handling & storage with manufacturing. **6 Hours**

### **UNIT- 8**

**AUTOMATED INSPECTION AND TESTING:** Statistical quality control, Automated inspection principles & methods, Sensor technologies for automated inspection, Co-ordinate measuring machines, other contact inspection methods, Machine vision, Optical inspection methods, Non-Contact inspection methods. **6 Hours**

### **TEXT BOOKS:**

1. **Automation Production Systems and Computer Integrated Manufacturing** - Mikell P. Groover – PHI, New Delhi - 2003.

### **REFERENCE BOOKS:**

1. **CAD/CAM** - Mikell P. Groover and Emory W. Zimmers - PHI, New Delhi - 2003.
2. **Numerical Control and Computer aided Manufacture** - Pressman and Williams - PHI – 1991.

## PRODUCT DESIGN & MANUFACTURING

Subject Code	:	10IP 844	IA Marks	:	25
No. of Lecture Hours./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours.	:	52	Exam Marks	:	100

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### PART - A

#### UNIT - 1

**Introduction To product Design:** Asimow's Model : Definition of product Design, Design by Evaluation, Design by Innovation, Essential Factors of Product Design, Production-Consumption Cycle, Flow and Value Addition in the Production-Consumption Cycle, The Morphology of Design ( The seven Phase), Primary Design phase and flowcharting , role of Allowance, Process Capability, and Tolerance in Detailed Design and Assembly.

**6 Hours**

#### UNIT – 2

**Product Design Practice And Industry:** Introduction, Product Strategies, Time to Market, Analysis of the Product, The three S's, Standardization, Renard Series ( Preferred Numbers), Simplification, The designer and His Role, The Designer: Myth and Reality, The Industrial Design Organization, Basic Design Consideration, Problems faced by Industrial! Designer, Procedure adopted by Industrial Designers, Types of Models designed by Industrial Designers, What the Designer contributes, Role of Aesthetics in product Design, Functional Design Practice.

**6 Hours**

#### UNIT – 3

**Review of Strength Stiffness And Rigidity Consideration In Product Design:** Principal stress Trajectories (Force – Flow Lines), Balanced Design,

Criteria and Objective of design, Material Toughness: Resilience, Designing for Uniform Strength, Tension vis-à-vis Compression. **4 Hours**

**Designing With Plastic, Rubber, Ceramics and Wood:** Approach to Design with Plastic, Plastic Bush Bearings, Gears in plastic, Fasteners in plastic, Rubber parts, Design Recommendation for Rubber parts, Distortion in Rubber, Dimensional Effects Tolerances, Ceramics and Glass parts, production Design Factors for Ceramics parts, Special Considerations for Design of Glass parts, Dimensional Factors and Tolerances, Wood.

**4 Hours**

#### **UNIT – 4**

**Design of production – Metal Parts:** Producibility Requirements in the Design of Machine Components, Forging Design, Pressed Components Design, Casting Design for Machining Ease, The Role of process Engineer, Ease of Location and Clamping, Some Additional Aspects of production Design, Die Casting and Special Casting, Design for Powder Metallurgical Parts, Expanded Metal and Wire Forms.

**6 Hours**

### **PART - B**

#### **UNIT –5**

**Optimization In Design:** Introduction, Siddal's Classification of Design Approaches, Optimization by Differential Calculus, Lagrange Multiplies, Linear Programming (Simplex Method), Geometric Programming, Johnson's Method of optimum Design.

**6 Hours**

#### **UNIT –6**

**Economic Factors Influencing Design:** Product value, Design for Safety, Reliability and Environmental Considerations, Manufacturing operations in relation to Design, Economic Analysis, Profit and Competitiveness, Break-even Analysis, Economics of a New product Design (Samuel Eilon Model).

**6 Hours**

#### **UNIT – 7**

**Human Engineering Considerations In Product Design:** Introduction, Human being as Applicator of Forces, Anthropometry: Man as occupant of Space, the Design of Controls, The Design of Displays, Man/Machine Information Exchange.

**5 Hours**

**Modern Approaches To Product Design:** Concurrent Design, Quality Function Deployment (QFD).

**2 Hours**

#### **UNIT – 8**

**Value Engineering and product Design:** Introduction, Historical perspective, What is value? Nature and Measurement of value, Maximum value, normal Degree of value, Importance of value, The value Analysis job plan, Creative, Steps to problem – solving and value Analysis, value Analysis

Test, value Engineering Idea Study on Tap Switch Control Assembly, Material and process Selection in value Engineering . **7 Hours**

**TEXT BOOKS:**

1. **Product Design and Manufacturing** - A.C. Chitale and R.C. Gupta - PHI.
2. **Product Design & Development** – Karl T. Ulrich & Steven D., Epingar Tata. - Mc Graw Hill - 3<sup>rd</sup> Edition, 2003

**REFERENCES BOOKS:**

1. **Product Design** - Kevin otto and Kristini - wood Pearson Education - 2004.
2. **New product Development** - Tim Jones, Butterworth Heinmam, Oxford - UIC -1997.
3. **New product Development: Design & Analysis** - Roland Engene Kinetovicz - John Wiley and Sons Inc., N.Y. – 1990.
4. **Successful Product Design** - Bill Hollins, Stwout Pugh, Butterworth - London 1990.
5. **Design for Assembly, a Designer,s Hand book** - Boothroyod & Dewhurst P. - University of Massachusets, Amherst - 1983.

## ENGINEERING SYSTEM DESIGN

Subject Code	: 10IP 845	IA Marks	: 25
No. of Lecture Hours./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours.	: 52	Exam Marks	: 100

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### PART- A

#### UNIT - 1

**INTRODUCTION:** What is Designing?, Early Man as a Designer, Design by evolution, Examples, Inadequacy of Evolutionary Method in Modern Design Situation, Systems Approach to Engineering Problems. **3 Hours**

**THE DESIGN PROCESS:** The Structure of the Design Process, Morphology of Design, Design Process-Decision Making and Iteration.

**3 Hours**

#### UNIT - 2

**IDENTIFICATION AND ANALYSIS OF NEED:** Realization of Need, preliminary Need Statement, Analysis of Need Specifications, standards of Performance, Environmental factors, Resources and Constraints, Examples.

**6 Hours**

#### UNIT - 3

**ORIGINATION OF DESIGN CONCEPTS:** Solving the Design Problem-Creativity, The Creative Attitude, The Creative Process, Mental Fixity, Creativity by Analogy with Systems, Use of Check Lists.

**6 Hours**

#### UNIT - 4

**SOME DESIGN METHODS:** Strategies for Search for Design Concepts, Morphological Analysis, Analysis of Interconnected Decision Area, Brain

Storming, Synectics, Examples to Demonstrate the use of Each Technique.

**7 Hours**

## **PART– B**

### **UNIT - 5**

**THE DESIGN DECISION:** The Place of Decision Making in Designing, A Measure of Physical Realizability- Example, Economic and Financial Feasibility, The Quality of Design, The concept of utility, Using Utility for Design Selection, Multi-Criteria Decisions, Decision Making Under conditions of Chance Variation.

**7 Hours**

### **UNIT - 6**

**DEVELOPMENT OF DESIGN:** From Concept to Product, Designing for Function, Designing for Production, Designing for Shipping, Handling, and Installing, Designing for Use, Designing for Maintenance, Compatibility Analysis, The Detailed Design.

**6 Hours**

### **UNIT – 7**

**ECONOMICS, OPTIMIZATION AND RELIABILITY IN ENGINEERING DESIGN (NO NUMERICAL PROBLEMS):** Place of Economics in Design, Quick Revision of Economic Concepts such as Fixed costs, Variable Costs, BEP, Designing for Profit, Need for Optimization, Quick revision of Optimization through Linear Programming.

**6 Hours**

### **UNIT - 8**

**RELIABILITY:** Introduction, A Measure of Reliability, Reliability of Assembled Systems –Series, Parallel, and their Combination.

**3 Hours**

**HUMAN FACTORS IN DESIGN:** Introduction, Man-Machine Interface, Displays and controls, actors influencing their Design, Examples.

**5 Hours**

### **TEXT BOOK:**

1. **An introduction to engineering Design Methods** - Vijay Gupta and P.N. Murthy - Tata Mc Graw Hill Publishing company Limited.

### **REFERENCE BOOKS:**

1. **The Creative Problem Solver's Tool box – A complete Course in the Art of Creating Solutions to Problems of any kind** - Richard Fobes - University Press - 1999.
2. **How to be better at Creativity? The industrial Society** - Geoffrey Petty.

## **AUTOMOBILE ENGINEERING**

Subject Code	: 10IP 846	IA Marks	: 25
No. of Lecture Hours./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours.	: 52	Exam Marks	: 100

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### **PART - A**

#### **UNIT-1**

**INTRODUCTION TO AUTOMOBILE SYSTEMS:** Spark Ignition (SI) and Compression Ignition (CI) engines, Cylinder arrangements, and their relative merits. Cylinder liners, Piston, Connecting rod, Crank shaft, Valves and Valve actuating mechanisms, Valve and port timing diagrams. Types of combustion chambers. Methods of swirl generation, choice of materials for various engine components. Cooling requirements, methods of cooling, thermostat valves. Different lubricating systems. **8 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, CD and CC carburetors, multi point and single point fuel injection systems, fuel transfer pumps, fuel filters, fuel injection pumps and injectors. **6 Hours**

#### **UNIT-3**

**IGNITION SYSTEMS:** Battery Ignition system, Magneto Ignition system, Transistor assisted contacts, Electronic ignition. Automatic Ignition advance for load and speed. **6 Hours**

#### **UNIT -4**

**SUPER CHARGERS AND TURBO CHARGERS:** Naturally aspired engines, Forced Induction, Types of Superchargers, Turbochargers construction and operation, Intercooler, Turbocharger lag.

**6 Hours**

#### **PART - B**

#### **UNIT -5**

**POWER TRANSMISSION: TYPES OF CLUTCHES:** Single plate, Multi plate and Centrifugal clutches. Fluid Flywheel. Numerical calculations for torque transmission by clutches. Gear Box: Necessity for gear ratios in transmission, Synchronesh gear boxes, Three, Four and Five Speed gear boxes. Overdrive, Torque convertors. Epicyclic gear boxes, Principle of automatic transmission. Calculations of road resistance and tractive effort, calculation of gear ratios.

**8 Hours**

#### **UNIT-6**

**DRIVE TO WHEELS:** Propeller shaft & Universal joints, Hotchkiss and Torque tube drives. Differential, rear axle, different arrangements of fixing the wheel to rear axle, Steering geometry, & steering gears, centre point steering, Wheel attitudes, Camber, Caster, King pin Inclination, Toe-in and Toe-out. Over steer, Under steer and Neutral Steer.

**6 Hours**

#### **UNIT-7**

**SUSPENSION, BRAKES AND TYRES:** Suspension requirements, Torsion bar, Leaf spring, Coil spring, Independent suspension for front and rear wheels. Air suspension system.

**BRAKES:** Different types of braking systems:

Mechanical, air-brakes, vacuum and hydraulic braking systems. Construction and working of master and wheel cylinders. Disc brakes and drum brakes. Anti-lock Braking system.

Tyres: Types of tyres causes and types of tyre wears.

**6 Hours**

#### **UNIT -8**

**ELECTRICAL SYSTEMS AND AUTOMOTIVE EMISSION CONTROL SYSTEMS:** Electrical system: Generator, voltage regulator, cut-out starter. Automotive emission controls, controlling crankcase emissions, evaporative emissions. Cleaning the exhaust gas. Exhaust gas recirculation. Air-injection system, Air-aspirator system, Catalytic convertors. Emission Standards: Euro-I, II, III and IV Norms.

**6 Hours**

#### **TEXT BOOKS:**

1. **Automotive Mechanics** - S. Srinivasan - Tata McGraw Hill - 2003.

2. **Automobile Engineering** - Kirpal Singh - Standard Publishers and Distributers - Vol I and II, 2002.

**REFERENCE BOOKS:**

1. **Automotive Engineering** - R. B. Gupta - Satya Prakashan - 4<sup>th</sup> Edition, 1984.
2. **Automobile Mechanics: Principles and Practices** - Joseph Heiter - D Van Nostrand Company Inc.
3. **Automobile Mechanics** - Crouse - Tata McGraw Hill - 10<sup>th</sup> Edition, 2007.
4. **Problems in Automobile Mechanics** - N.K. Giri - Khanna Publishers - 4<sup>th</sup> Edition, 1988.
5. **Internal Combustion Engines** - Mathur and Sharma - Dhanpath Rai and Sons - 1994.