MATHEMATICS-III

THEORY-100	Pass Marks-35
SESSIONAL-50	Pass Marks-25

L T P
3 1 0
Time-3 hrs

UnitI - Linear Algebra   40 Marks

Some special type of matrices such as symmetric and skew symmetric, hermitian and skew- hermitian, nilpotent, involuntary, orthogonal, unitary and their properties; Triangular and echelon form, pivot elements; Trace, Differentiation and integration of matrices; Inverse of matrix , Theorems on inverse, elementary operations and elementary matrices, equivalent matrices, computation of inverse by elementary transformations, reduction of matrices to triangular form and normal form; partitioning, inverse by partitioning, rank of a matrix, evaluation of rank.

Vector spaces and subspaces, linear independence, basis and dimention, Row space, column space, null space, row rank, column rank equality of row rank, column rank and rank of a matrix.

Solution of a system of non-homogeneous linear equations, solution of a system of homogeneous linear equations, Consistency of a system of linear equations.

Orthogonally: Inner product, orthogonal vectors, orthogonal metrics and Gram-Schmidt orthogonalization.

Eigen values and Eigen vectors and their properties, Cayler-Hamilton's theorem, Reduction of a matrix to diagonal form, necessary and sufficient condition for diagonalization.

UnitII-Statistics   40 Marks

Probability, probability distributions and characteristics: Dispersion skewness and kurtosis, random experiments and sample space, definitions of probability, Laws of probability, Baye's theorems, random variables, Probability distributions of a discrete random variable, Mean and Variance of a discrete random variable, Probability distribution of a continuous random variable, Expectation and moments, Binomial distribution, Poisson distribution, Normal distribution.

Elementary sampling theory: sampling with and without replacement, Sampling distribution of mean, proportion, sum and difference. Central limit theorem and its significance.
Statistical estimation theory: Biased and un-biased estimates, efficient estimates, point & interval estimates. Confidence limits for the estimates of mean, proportion, difference and sum

Statistical decision theory: Statistical hypothesis, null hypothesis, test of significance involving normal distribution

Unit III Laplace tranformation   20 marks

Laplace transformation of elementary functions, inverse laplace transform, linearity, laplace transform of derivatives & integrals, shifting theorems, laplace transform of unit step function, Dirac-Delta function, differentiation and integration of transforms, convolutions, application to differential equations

Text & References
1. Advanced Engg Maths – by Peter V O Neil – Wiley Eastern Ltd
2. Advanced Engg Maths – jain & Iyengar - Narosa
3. Higher Engg Maths – B S Grewal – Laxmi Publications

Mathematics IV 　　　3　　1　　0
(For all branches except Civil & Chemical)
Theory-100　　　　　　　　　　　　　**Pass Marks-35**
Sessional-50　　　　　　　　　　　　**Pass Marks-25**
　　　　　　　　Time-3 hrs

UnitI: Series Solution: 　　　　　　　　　　　　　　25 Marks

Power series solution of initial value Problems, Power series solution using recurrence relations, singular points and the methods of Frobenius, solution of Bessel's equation and Bessel's functions, solution of Legendre's equation and Legendre's polynomials, orthogonal sets of functions, strum-Liouville Problem, eigen values and eigen functions of a singular problem, Bessel's functions as eigen functions of a singular problem, Legendre's polynomials as eigen functions of singular problem , strum-Liouville Theorem (only statement) ; eigen function expansions.

UnitII: Partial differential equations: 　　　　　　　　　　35 Marks

Basic concepts, Formation of partial differential equations, equation solvable by direct integration, linear and non-linear equations of first order . Homogeneous linear equation with constant co-efficients, solutions of heat equations, wave equations, transmission line equation and Laplace equation

UnitIII: Tensor analysis:
20 Marks
Curvilinear coordinates , unit vectors in curvilinear system, Representation of a vector F in terms of unit base vectors, contravariant and covariant components of F; Arc lenth and volume element in orthogonal curvilinear coordinates;Transformations of coordinates; Definition of tensor, Fundamental operations with tensors, Symmetric and Skew-Symmetric tensors, Riemannian space and metric tensor, Conjugate tensor, Christoffel symbols.

UnitIV: Calculus of Complex Variables: 　　　　　　　　　20　Marks

Analytic functions, C-R equations, conjugate functions, Harmonic functions, orthogonal systems, Formation of analytic function, conformal mapping, Integration of a complex function, Cauchy's integral Theorem, Power series representation of complex functions, Laurent's series , Singularities, Residue Theorem.

Text/Reference:
1.Advanced Engg. Mathematics 　　　　:E.Kreyszig 　　　　　　　:Wiley Eastern Ltd

2.Advanced Engg. Mathematics	:Peter V O' Neil	:Thomson books
3 Advanced Engg. Mathematics	:R.K.Jain&S.R.K Iyenger	:Narosa
4.A Text book of Engg. Maths	:Bali,Saxena,Iyenger	:Laxmi Publication
5 Higher Engg. Maths	:B.S.Grewal	:Khanna Publication
6.Calculus	:James sewart	:Thomson books
7.Elements of Partial Differential eqs.	:I.M.Snedon	:Thomson books

ME 305: BASIC THERMODYNAMICS (3-1-0) (for ME, IP, EE, ET, INS,CH)

Theory: 100 Sessional: 50 Time: 3hours

System and Continuum:
Intensive and Extensive properties – Thermodynamic state, pressure, energy, work and heat – process and cycle – Macroscopic and Microscopic points of view – Kinetic theory of gases.

Laws of thermodynamics:
Zeroth law – Concept of equilibrium – Principles of thermometry – Fixed points.
First law of thermodynamics and its application to open and closed systems – Concept of internal energy – Steady flow energy equation – Processes of closed systems.
Second law of thermodynamics – Various statements – Carnot cycle – Irreversible and Irreversible processes – Thermodynamic efficiency and temperature scales – Concept of entropy – Entropy changes in various processes.

Properties of steam:
Latent heat – Saturation pressure and temperature – Dryness fraction – Degree of superheat – Total heat; Rankine cycles.

Air standard cycles:
Otto, Diesel – Principles of working and description of two and four stroke SI and CI engines – Representations of processes on T-S and p-v diagrams.

Fuels and Combustions: Classification of fuels; HCV, LCV, Bomb Calorimeter, Boy's gas calorimeter; Combustion of fuels; Minimum air required (by weight and by volume); Conversion of volumetric analysis into weight analysis and vice verse; excess air and Orsat apparatus.

Books:
1. Engineering thermodynamics by P K Nag, Tata McGraw Hill Publication
2. Fundamentals of Thermodynamics by Cengel and Boles, Tata McGraw Hill Publication
3. Fundamentals of Engineering Thermodynamics by E. Rathakrishnan, PHI

ME322: THEORY OF MACHINES(3-1-3) (for ME,IPE)
Theory: 100, Sessional: 50, Laboratory: 50, Time: 3hrs
1. Kinematics: Link, Pair, chain, mechanism and inversions. Simple mechanism (description only), Slider crank, four bar, straight line steering. Simple velocity and acceleration diagrams,
2. Strain energy, Virtual work, Introduction to vector approach.

3. Governor: Watt and porter governors. Spring controlled centrifugal governor – Hartnell, Hartung, Wilson –Hartnell, Inertia governors. Stability, Effects of friction, Isochronism, Hunting, effort and power.

4. Flywheel: Fluctuations of energy, Co-efficient of fluctuation of energy and speed, function of flywheel.

5. Brake and Clutch: Working principles only. Simple problems illustrating use of above.

6.Belt and Rope Drive: Relations for torque, maximum power transmission, length of open cross belting slip, crowning of pulley.

7. Gear and Gear train: Nomenclature, types – simple, compound , epicyclic gear train including reverted gear train. Simple description of automobile gear train.

Laboratory: Six experiments covering the syllabus.
Books: 1.Theory of Machines by J. Lal , Metropolitan Books Ltd.
      2. Theory of Machines and Mechanisms(3rd edition) by J.J.Uicker,
        Jr;G.R.Pennock & J.E.Shigley, Oxford University Press.
      3. Theory of Machines by V.P.Singh,
      4. Theory of Machines by A. Shariff

ME 323: ENGINEERING GRAPHICS – III   (1-0-6) (for ME,IPE)
Full marks: 100, Sessional: 50, Laboratory: 50, Time; 3hours

SCREW THREAD & SCREWED FASTENER:
Profiles of various threads; Representations of various kinds of threads; Different types of nuts and bolts; Locking devices for nuts.

RIVETTED JOINTS:
Different types of Laps and Butt joints; Rivetted joints of plates at right angles.

KEYS, JOINTS & COUPLINGS:
Different types of keys; cutter joints; knuckle joints; muff coupling; flange coupling; universal couplings.

PULLEYS:
Stop pulley and V-belt pulley.

PIPE JOINTS:
Flanged joint; Hydraulic joints.

GEARINGS:
Construction and representation of involute teeth profile and nomenclature.

ASSEMBLY DRAWING:
Engine parts: 1) Piston, 2) stuffing box, 3) Cross-head 4) Connecting and connecting ends 5) Eccentric.

Valves:
1) Stop valve, 2) Feed check valves 3) Blow off cock 4) Non-return valve.

Bearings: 1) Thrust bearing 2) Pedestral bearing

Computer aided drafting, Introduction to autocad – solid modeling, Computer graphics.

Detailed workshop drawing:
Pipe vice, Chuck, Tail stock of lather screw jack; different symbols in workshop drawing.

Books:
1. Machine drawing – N D Bhatt.

IP 334 : MANUFACTURING PROCESS – I [3-1-3]
Theory-100marks Sessional-50marks Lab./ Practical-50 marks Time 3 Hrs

Unit I: **General Introduction** Introduction to the subject – Classification (only) of manufacturing processes – Concept of of manufacturing -- Manufacturing system.
General maintenance of workshop -- Cleaning and Lubrication -- safety in the workshop -- precautions against accidents -- workshop lighting.

Unit II : **Introduction to Metrology** Standards of measurement, sub-division of standards -- line and end standard : rules and slip gauges -- use of vernier calliper, micrometer calliper, height and depth gauges. Wire gauge, radius gauge, thread gauge, feeler gauge, bore gauge, straight edges -- uses.
Bevel protector and combination set : sine bar and angle gauges spirit level, clinometers, dial indicators -- surface plate and V-block : Definition of flatness and waviness of surface.

Unit III : **Limits, Fits and Tolerances.** Introductory concept of limits of size and its representation. Types of Fits -- Tolerances -- I.S. code for grades of tolerance and fit -- Hole basis and shift basis system.
Concept of Inter-changeability -- selective Assembly.

Unit IV : **Sand Moulding.** Introduction -- hand tools and basic equipments. Preparation of simple sand mould -- core making and types : Pattern making -- materials, types and allowances – Moulding process. Moulding sand and additives -- sand characteristics and testing.

Unit V : **Smithying** Introduction -- hand tools and equipments in hand forging -- Smith's forge or hearth : anvil, swage block, Hammers and its classification, tongs, Chiessels, Hardie and gauges, Punches and drifts, Fullers, swages, flattes, Set hammers, blowers.
Simple hand forging operations -- Forgeability.

Unit VI : **Bench Work and fitting** Tools and instruments -- files, scrapers, chisels, hack saws. Single scribing block of surface gauge and Universal surface gauge -- punches and hammers, Callipers, dividers.
Processes -- marking, clipping sawing, filling, draw filing, drilling tapping and dieing. Do and donots in filing.

Unit VII : **Welding** Introduction -- advantages and limitations -- welding process and application : pressure and fusion welding : Gas, arc and resistance welding -- Equipments used in gas welding : Oxy-acetylene gas cutting -- weldability of metals and alloys.
Soldering and brazing.

Unit VIII : **Single point cutting tools** Nomenclature and tools signature -- Tool geometry and effects of toold angles -- Tool sharpening -- Tool materials.

Unit IX : **Metal cutting** Elements of metal cutting -- chip formation and types of chip : chip breakers -- cutting fluid -- machinability. Tool life : Taylor's equation -- Tool wear, types and mechanism.

IP 434 : MANUFACTURING PROCESS -II [3-0-3]
Theory-100 marks Sessional-50 marks Lab/Pract50 marks Time 3Hrs

Unit I : **Mechanics of Metal Cutting** Orthogonal and oblique cutting : chip thickness ratio, velocity relationships. Merchants's theory of metal cutting and Force relationship ; stress and strain and power consumption. Heat zones metal cutting. Economics of metal cutting.

Unit II : Lathe Classification, specification and size – lathe parts, work holding devices ; Lathe operations – Taper tuning, Thread cutting, Speed, feed and depth of cut. Calculation of machining time.

Unit III : Drilling, Boring and Reaming Types of drilling machines , parts and their functions; drill types, twist drill terminology ,drill chucks—special drilling machines; speed, feed, torque and power consumption ; machining time. Deephole drilling and Trepanning. Boring operation ; boring machine – Jig boring machine. Reaming – Reamer geometry, reaming allowances on a drilled hole.

Unit IV : Shaping, Planning and Slotting machine Classification, specification and size – principle of Quick return mechanism. Stroke length and Position adjustment of the ram. Simple operations – tool machining time.

Unit V: Milling Milling machine classification, milling spindle details, milling cutter types, Geometry of plain cutter. Milling operation – up-milling and down-milling ; End, Gang and Form milling. Indexing – milling threads, gear and splines.

Unit VI: Grinding Types, specification and size of grinding machine. Grinding wheel – abrasive, bond, grift, structure, grain size ; wheel dressing, truing, balancing and mounting – soft and hard wheels ; selection of wheels. Operation – grinding of flat, cylindrical and contoured surfaces. Centreless grinding.

Unit VII: Broaching Types of broaching – broach tools – examples of broach work.

Unit VIII: Micro-finishing Processes Different processes – Grinding, Lapping, Honing and super-finishing – Polishing, Buffing, Tumbling and Burnishing.

EE 303: Electro Technology-I (3-1-2) (ME,IPE&CHE)
Theory Marks=100, Sessional Marks=50, Laboratory Marks=50

1.   **D C Machines:** Basic Constructional features, EMF Equation of D C generator, Elementary Idea of D C machine winding-winding pitch, Lap and Wave windings. Types of generators. Characteristics of D C generator-the OCC and the load characteristics . The shunt generator-condition for voltage builds up. Load characteristics. Losses in a D C generator, Efficiency, Applications, Compound generators

Working principle of DC motor, Back EMF, Calculation of torque and power. Types of DC motors, Characteristics curves, Losses and efficiency, Speed equation. Method of speed control, method of starting. The three point, four point starter (calculations of the star resistors not required)

2.   **Transformers:** physical description, elementary theory of the ideal transformer, EMF equation, voltage & current transformation ratio, no load and load phasor diagram. Transformer reactance and impedances. Equivalent resistance and reactance. Simplified equivalent circuit, open and short circuit tests. Losses & efficiency. Condition for maximum efficiency. All day efficiency. Voltage regulation. Star and delta connection in three phase transformer. The auto transformer, basic working principle

3.   **Induction motor:** Constructional features of three phase induction motor-principle of rotating magnetic field (mathematical treatment not required) Principle of operation of the 3-ph induction motor speed. Rotor EMF , current and rotor cu loss, Torque ,Starting torque .Maximum torque . Condition for maximum torque . Torque slip curves. Necessity of a starter .Methods of starting of squirrel cage and the slip-ring induction motors.

Introduction to single phase induction motor. Nature of a field and torque produced in single phase induction motors (details of double revolving field not required). Types of motors –split phase , capacitors motors.

4. **A.C. Synchronous machines**:

Principle of operation of alternators. Constructional features of cylindrical generators and salient pole generators, EMF equation, Armature reaction. Synchronous impedance. Regulation of alternators, determination by synchronous impedance method.

Principle of operation of the synchronous motor, synchronous motor on no load, synchronous motor on load, behaviour of the synchronous motor with change of excitation –V curves. Starting methods of synchronous motor. Application of synchronous motor.

5. Measuring Instruments:

Dynamometer type wattmeter. Induction type wattmeter. Single phase induction type energy meter. Errors and compensations.

Books:

1.Langsdrof: Theory of Alternating current Machines'- Tata McGraw Hill

2. Kingsley , Fitzereld: Electric Machinery(McGraw Hill)

3. Say: Performance and Design of Alternating Current Machine.

4. Guru, B.S., and Huseyin R. Hiziroglu, Electric Machinery and Transformers, Oxford University Press

5. Kothari D.P. , and Nagrath, I.J., 'Electrical Machines' Tata McGraw Hill

6. Electrical Measurements and Measuring Instruments-A.K. Shawney (Dhanpat Rai)

E.T. (3rd Sem Lab)

1. Open circuit Characteristic of D.C Generator.
2. Load Characteristics of D.C. Shunt Generator.
3. Speed Control of D.C. Shunt motor.
4. Open circuit and short circuit Characteristics of single-phase transformer.
5. Load Characteristics of single-phase transformer.
6. Power measurement by two-wattmeter method.

E 441: ELECTRO-TECHNOLOGY-II (ME,CHE)

1. Analog Electronics:

The bi-polar transistor (BJT)-PNP and NPN types. Construction and working principle. Identifying the leads of the transistor. Transistor as an amplifier. Transistor as an amplifier. Transistor configurations-CB,CE and cc. Characteristics of CE configuration. and factors and their relation. Biasing of transistor. Operation point. Load line analysis. Performance of the transistor amplifier-input and output resistance, effective collector load, voltage gain and power gain. Graphical representation of working of the single stage amplifier. Field Effect Transistor (FET)-construction and working principle. Difference between BJT and FET.

2. Digital Electronics:

Digital signals. Basic building blocks in digital electronics-NOT,AND and OR gates. The NAND, NOR and EX-OR gates. Boolean algebra, DeMorgans's theorems.

Number system and codes-the decimal, the binary, octal and hexadecimal number systems: conversion from one another.

Combinational logic design: -standard representation of logical functional in SOP and POS forms. Logic design in SOP form- truth table to logic equation to realization using gates. Reduction of logic equation. Introduction to half adder, full adder, BCD to 7 segments display decoder. ADC, DAC (to be treated as black boxes)

3. Introduction to feed back control systems:-(For Mechanical Engineering students only)

Definition of open loop and closed loop control . Open loop Vs closed loop control. Servo-mechanism and regulation systems.

A reference to other types of control . Description of a practical feedback control system.

Block diagram representation of control system. Transfer functions. Block diagram reduction. Mathematical models of physical systems-modelling of simple electrical and mechanical systems (translational and rotational). One simple example.

Time response of control systems-the unit step, unit ramp and unit acceleration test inputs, First and second order systems, Steady state errors. Introduction to proportional plus derivative control of 2nd order system..

4. Transducers-(For Chemical Engineering students only)

Functional elements. Mechanical and electrical transducers. Primary and secondary transducers ,active and passive transducers. Inverse transducer- piezo single-phase transformer o electric transducers. Basic requirements of transducers.

Temperature transducers- Thermistor, thermocouple ,characteristics of thermocouple transducers, Resistance –Temperature detector (RTD);Solid state sensor-transistor used as a temperature sensor.

Pressure transducers-Elastic element used as pressure sensors-membranes, thin plates corrugated diaphragms, capsules, bellows ,Bourdon tube. Transducers types-LVDT,RVDT, variable capacitance. Digital transducers.

Flow transducers-restriction flow transducers, obstruction flow transducers and magnetic transducers.

5. Electric Heating and Welding:

Advantage of electric heating . Resistance heating-direct and indirect type. Heating elements. Temperature control.

Electric arc furnace-direct type, indirect type, power supply and heat control.

Induction Heating-principle, skin effect, depth of penetration; induction furnace-different types.

Dielectric Heating-principle and applications.

Electric welding-arc welding , dc generator for arc welding, welding transformer, Résistance welding.

Books:
1. Ogatta-Modern Control Engg.
2. Swahney-EMMI
3. Digital Electronics-R.P.Jain
4. V.K.Mehta-Principles of electronics.
5. Art and Science of utilization of electrical energy-H.Partab
6. Utilization of electrical energy-Elgerd

IP 435 : INDUSTRIAL STATISTICS [3-2-0]
Theory-100 marks Sessional-50 marks, Time-3 Hrs

Unit I: Basic Statistical Concept Method of collection and presentation of data – variables and attribute.   The frequency distribution and its graphical representation :   normal distribution.

Measurement of Central tendency and dispersion.

Unit II:Probability Definition and basic laws of probabilities, conditional probability, random variables, binomial, Poission's & normal distribution (only properties and applications) sampling distributions :   statistical hypotheses.

Statistical tests of significance, correlation and regression analysis. Auto-correlation.

Unit III :Statistical Quality Control Control charts for variables -- X & R chart and control charts for attributes -- P and C charts.

Unit IV:Acceptance Sampling Introduction – Methods, The O.C. Curve : Quality indices for acceptance sampling plans -- design of an acceptance plan.

Unit V:Analysis of variance & Design of Experiments One way & two way classification, Basic Experimental design : Randomised block, Latin square, Factorial 22 experiment.

Unit VI : Introduction to stochastic problems in engineering.

Reference Books
1) Statistical Methods ---- an introduction by J. Medhi.
2) Fundamentals of Statistics Vol – II by A.M. Goon, M.K. Gupta and B.D. Gupta (Chapters 20, 27)
3) Fundamentals of Applied Statistics by S.C. Gupta and V.K. Kapoor (Chapter 5 & 6)

IP 437 : MATERIAL SCIENCES AND TECHNOLOGY   [3-1-2]
Theory-100marks Sessional-50marks Lab./ Practical-50marks Time 3Hrs

Unit I:Crystal Structure Atomic bonding, packing and crystalline structure – unit cell,

Miller indices, crystal imperfections. Determination of grain structure by light microscope, electron microscope and X-ray diffraction.

Nucleation, grain growth from liquid phase, dendritic growth.

Unit II :Deformation in solids Slip and twining, critical resolved shear stress. Fracture – brittle and ductile, Griffith's theory. Elastic after effect, Bauchinger effect, Season cracking and preferred orientation.

Work Hardening – concept, theory and stages.

Recovery, recrystallisation and grain growth.

Unit III : Phase diagrams Gibb's phase rule – simple binary phase diagrams, Lever rule. Iron – Carbon equilibrium diagram – eutectic. Peritectic and eutectoid reactions – microstructure. T-T-T diagram.

Unit IV : Heat Treatment Objectives and principle – General heat treatment processes – hardenability and Jominy hardness test.

Heat treatment of steel.

Unit V : Steel and cast Iron Classification and types – Effect of alloying elements ; Tool and die steels. Spring steels, heat and Scale resistance steels. Non-ferrous alloys : babbits : copper-based, aluminium-based and nickel based alloys.

Unit VI:Corrosion Definition, factors influencing corrosion, types of corrosion, basic corrosion mechanisms, specific types. Control and prevention, Oxidation.

Unit VII : Material Testing Testing for tensile and compressive strength, hardness, impact and bend test – Fatigue and Creep testing. Non-destructive testing.

ME525: INSTRUMENTATION (3-1-3)
Theory: 100 Sessional: 50 Laboratory: 50 Time: 3hours

1. Definition of Instrumentation.
2. Dynamic characteristics of instruments and instrumentation system, Linear and non-linear systems, Electrical networks, Mechanical systems, Analogous systems, Thermal systems, First and Second order systems.
3. Measurement of linear displacement and linear displacement transducer (i) Resistance potentiometer, (ii) Strain gauge, (iii)Variable inductance transducers, (iv) Linear variable differential transducers(LVDT), (v) Capacitive transducers, (vi) Piezo electric transducers.
4. Measurement of rotary displacement and rotary displacement transducers (i) Resistance potentiometer, (ii) Strain gauge, (iii) Rotary variable differential transducers, (iv) Capacitive transducers, (v) Shaft encoder.
5. Strain gauges: Measurement of strain and applications of strain gauges.
6. Measurement of pressure with secondary transducers (i) Resistive , (ii) Inductive , (iii) Capacitive, (iv) Piezo-electric transducers.
7. Measurement of torque (i) Strain gauges, (ii) Torque meters, (iii) Inductive torque transducers, (iv) Digital method, (v) Magneto-stricture transducers.
8. Measurement of linear velocity (i) Moving magnet type transducer , (ii) Moving coil type transducer, (iii) Seismic type velocity transducers.
9. Measurement of angular velocity: (i) AC and DC tachometer generators, (ii) Drag cup rotor AC, (iii) Photo-electric tachometer, (iv) Stroboscopic methods.

10.   Measurement of vibrations: (i) Seismic transducers, (ii) LVDT accelerometers, (iii) Piezo-electric accelerometers.
11.   Measurement of temperature: (i) Platinum resistance thermometers, (ii) Thermocouples, (iii) Thermistors, (iv) Optical pyrenometers.
12.   Measurement of flow: (i) Turbine meter, (ii) Electro-hydro-dynamic flow meters, (iii) Hot wire anemometer.
13.   Measurement of sound using microphone.
14.   Measurement of thermal conductivity; (i) Gas analyzer (ii) Using thermistors.
15.   Cathode ray oscilloscope: observation of wave forms, measurement of voltage and current, Lissajous patterns for measurements of phase and frequency.
16.   Signal conditioning; (i) AC amplifiers, (ii) operational amplifiers and specifications, (iii) Charge amplifiers, (iv) Amplitude modulations and demodulations , (v) Different types of filters, (vi) Wheatstone bridge, (vii) Inductive transducers and AC bridges, (viii) Blumlein bridges, (ix) Integration and differentiations   (x) Analog- Digital   and Digital- Analog conversion techniques.
17.   Introduction to display devices.
18.   Recorders : (i) Analog recoprders, (ii) Strip chart recorders, (iii) Galvanometers type recorders, (iv) Null-type recorders, (v) X-Y recorders, (vi) Ultra-violet recorders, (vii) Magnetic tape recorders, (viii) Frequency method recorders, (ix) Pulse duration modulation recorders, (x) Direct recording, (xi) Digital tape recording .
19.   Control systems and components: (i) Linear approximation and non-linear system, (ii) Servo-motors, (iii) AC tachometer, (iv) Amplidyne, (v) AC position control system, (vi) Stepper motors.

References:
1.   A course in Electrical, Electronics measurements and Instrumentation-A.K.Shawney.
2.   Automatic control systems-Benjamin and Rao.
3.   Control system Engineering- I.J.Nagrath and M.Gopal.

ME 526:   MACHINE DESIGN I (3-0-3) (For ME & IPE)
Theory -100 marks Sessional-50 marks Time 4hours

Unit I: Introduction General considerations and procedure for designing, types of Loads, Designed stress and factor of safety, stress concentration, selection of materials, codes for design-BIS codes, Failure theories, Fits and Tolerance.
Unit II:Joints a)   Detachable joints: Design of threaded fasteners, thread forms and threaded fastener types and materials, bold tightening and initial tension, Power screws.
b)   Permanent Joints: Riveted joints and welded joints – eccentric loading.
Unit III:Shafting Design of shaft   subjected to bending, torsion, axial and combined loading, keys, cotter and Knuckle joint.
Unit IV: Coupling Rigid and Flexible coupling.
Unit V:Power Transmission Element Belt and Chain Drives, design of Flat and V-belts.
Unit VI:Bearing Journal Bearing, Mechanism of fluid film lubrication, fluid viscosity, Petroff's Equation.

Books: 1. Machine Design by Black and Adams (TMH)
        2. Design of machine elements by M F Spott
        3. Design of machine elements by B V Vandari (TMH)
        4. Machine Design by Hall

5. Machine Design by Khurmi and Gupta
6. Machine Design by Bahl and Goel
7. Machine Design by Shigley.

IP 532 :   FLUID MECHANICS AND MACHINES   [3-1-2]
Theory100 -marks Sessional-50 marks Lab./Pract.50 marks Time 3 hours

Unit I   Properties of Fluids and Fluid States Density, pressure, shear stress and velocity, compressibility, Gas laws, measurement of pressure – manometers, Buoyancy, meta centre, equilibrium of floating bodies ; Hydrostatic forces and centre of pressure on submerged bodies.

Unit II   Fluid Kinematics   Lagrangean viewpoint, Eulerian view point ; Streamline, Pathline, Streakline, Rotational and irrotational motion ;   Stream function, Potential function and Vorticity ; Steady flow, Unsteady flow.
        Basic laws : Continuity equation, Momentum equation Energy equation ; Bernoulli's equation ; Euler equation ; venturimeter ; orificemeter, pitot tube, pitot static tube.

Unit III   Flow of Real fluids   Reynold's number, Laminer flow, Hagen –poisseullie Equation, Turbulent flow. Darcy's Weisbach eaquation ; Basic of boundary layer theory, Losses in pipes. Dimensional analysis and similitude.

Unit IV   Hydraulic Turbines   Impact of jets on stationery and moving vanes ; Pelton Wheel, Francis turbine, Propeller and Kaplan turbine – construction, working principle, velocity triangle, governing mechanism and simple problems.

Unit V   Pumps   Centrifugal pump – construction, working principle, velocity triangle, Heads, NPSH, cavitation, simple problems. Reciprocating Pumps – construction, working principle, single-acting and double-acting pump, simple problems.

References :   1. Streeter and Wylie -- Fluid machanics, 6e, McGraw Hills inc.
                 2. Kumar, K.L.   ---   Fluid machanics
                 3. Lal, Gagadish ---   Fluid machanics, Hydraulic Machines
                 4. Rajput, R.K.   ---   A text book of Fluid Mechanics

IP 533 : MANUFACTURING PROCESS III [3-0-3]
Theory100marks Lab/Pract.50marks Sessional50marks Time 3Hrs

Unit I: Plastic Deformation of Metals. Theory of plasticity – Stress tensor, principal stresses ;Mohr's Circle representation of stress states. Field criteria, Von mises strain energy criterion. Mechanical working of metals – Hot and cold working.
Unit II   :   Forging The process – forgeability and grain flow pattern. Different forging operations ; forging hammers and presses. Forging design – forging defects.

Unit III :   Rolling   The principle and concept ;   hot and cold rolling – Rolling parameters and their effects – rolling forces. Rolling stud arrangement and roll passes – Break down passes. Tube rolling.

Unit IV :   Extrusion and Drawing   The Principle – hot and cold extrusion ;   Types and methods and application – extruding tubes. Drawing of wire, rod and tubes.

Unit V   :   Press Work and Sheet metal operations   Introduction – types of press and press safety devices – press working operation ; cutting and shearing, bending, forming, drawing, squeezing, embossing, coining and stretch forming.
        Stock layout ; defects in sheet metal formed parts – metal Spining.

Unit VI :Manufacture of threads and gears – different methods and finishing operations.

Unit VII :   Power Metallurgy. Introduction – Requirement and methods of working powders – the process. Primary and Secondary process – Typical applications.

Unit VIII   :   Coating of metal surfaces. Necessity – requirements of coating materials – organic and inorganic coatings.

Reference books   :

1. A courses in workshop Technology, Vol. I   ---------- B. S. Raghuwanshi.
2. Manufacturing Technology   ------ P. N. Rao.
3. Theory of Metal Forming and Metal Cutting   -------- K. P. Sinha and
                                                            S. C. Prasad.

IP 534 :   FOUNDRY AND WELDING TECHNOLOGY [3-1-3]
Theory100 marks Sessional50 marks Lab/Pract.50marks Time 3Hrs

Unit I   :   Solidification of Casting   Mechanism of solidification. Heat transfer between metal and mould ; importance of directional solidification and methods of obtaining it. Dissolved gases in molten metal and method of degassing.

Unit II   :   Casting design.   Functional design of casting – dimensional design such as minimum section thickness, dimensional tolerance, surface finish etc. Simplification of foundry practice such as selection of proper and economical moulding material and processes, elimination of curing etc. Metallurgical design such as selection and optimum use of casting alloy.

Unit III   :   Analysis of Casting Casting defects – Salvages and Rectification ; inspection of casting, cleaning and quality control.
        Heat Treatment and finishing operation on castings.

Unit IV   :   Special Casting Methods Permanent mould, slush and pressed casting ; die casting, centrifugal casting, investment casting and continuous casting. Application and economic study of the methods.

Unit V   :   Metals and their Weldability.   Definition and concept of weldability – effect of alloying eliment on weldability. Weldability testing. Welding metallurgy temperature changes and their effect on mechanical properties ; residual stresses and distortion – heat treatment. Absorption of gasses by weld and their effects.

Unit VI   :   Modern Welding Developments.   Submerged arc, shielded arc, atomic hydrogen thermit welding – brief study of the processes and applications.
        Survey of principles and application of electro slag, electron beam. FIG, MIG, laser, Plasma and ultrasonic welding.

Unit VII : Welding of C.I., Carson steels, stainless steel, aluminium and its alloys and copper and its alloys. Welding of practices.

Unit VIII : Welding electrodes – Classification and coding. Testing and inspection of weld.

<u>Reference books</u>

1. Principles of Metal Casting ---------- Weins Resenthal.
2. Fundamental of Metal Casting Technology ------ P. C. Mukherjee.
3. Fundamental of Metal Casting -------- R. A. Flin.
4. Metallurgy for Engineers ------ R. C. Rollason.
5. Welding Technology -------- Keonigs and Larger.
6. Welding Engineering ------- Rossi.
7. Metallurgy of Welding -------- Udin et al.

IPE 604: COMPUTER METHODS AND DATA PROCESSING
Duration of Examination: 3 Hrs
Theory: 100
Sessional/Lab: 100

Unit 1:

Basic elements and use of computers- Analog and Digital, Programming and software, Machine Language.

Unit 2:

MACHINE PROCESSABLE DATA, Number system, Alphanumerical system and organization of data.

Unit3:

Introduction to Data structures, Arrays, Lists, Stacks, Queues, trees, Graphs. Structured Programming using high level programming languages. Introduction to Data base management systems.

Unit 4:

Introduction to data processing- Processing facilities, Implication for production engineering and management, Industrial and production management problems of data processing.

Unit 5:

Processing equipment, computers and future developments. Applications through case studies.

Books:

1. Digital computer fundamentals- V. Rajaraman. P III

2. Introduction to Data Structures- Horowitz and Sahani, Galgotia Books
3. Introduction to Data base system- C.L. Date, Addission   WESLEY, 1985
4. First Course in Data base system- Jeffrey D Ullman and Jennifer Widom, Prentice Hall, 1997
5. Data structures; algorithms and software principles in C- Thomas A Standish, Addison, Wesley 1997

ME 621:   MACHINE DESIGN II (3-0-3) (for ME & IPE)

Theory 100 marks Sessional50marks Laboratory 50marks Time 4 hours

Unit I :   Design against static load Different type of load and stress, Mode of failure. Factor of Safety.

Unit II   :   Design against fluctuating load Stress concentration, fluctuating stresses, Fatigue failure, endurance limit, Notch sensitivity, cumulative damage in fatigue, Soderberg and Goodman Diagrams, Fatigue design under combined stresses.

Unit III   :   Design Considerations and simple cases of design for
a)   Mechanical Spring – helical spring
b)   Friction clutches – single and multidisc clutch, cone clutch
c)   Brakes – Disc, cone, band, and internal expanding shoes
d)   Spur Gear, Helical gear
e)   Bearing – radial and Thrust journal bearings, antifriction bearings
f)   Cams
g)   Gasket for static load, in vessel opening

Reference Books:
1. Machine Design (Tata McGraw Hills) ----- Blach and Adams
2. Design of Machine elements (-do-)   -----   B. V. Bhandari
3 Machine Design (….)   ------- Bahl & Goel
4. Machine Design   -----   Hall
5. Machine design   -----   Shigley
6. Design of Machine elements   -----   M. F. Spot.

ME 622: Operations Research (4-0-0) (for ME &IPE)
Theory100 Sessional 50 Time: 3hours

1. Introduction to OR, Engineering applications, Statement of an OR problem, Type of problems handled in OR.
2. (a) Linear programming (deterministic) – Problem formulation, Feasibility and Optimality, Basic and Non-Basic solutions
   (b) Graphical method of solving LPP, Simplex Algorithm and problem solutions, Use of Slack, Surplus and Artificial variables and their meanings
   (c) Big-M method and 2-phase method
   (d) Dual Simplex algorithm
   (e) Meaning and examples of Unique, Alternate/Multiple, Unbounded and Infeasible solutions.
   (f) Degeneracy and Cycling
3. Special Linear Programming problems – their formulations and solutions in such cases as Integer Programming Problem (IPP), Transportation Problem (TP) and Assignment Problem (AP). Discussion on method extended to Travelling Salesman Problem (TSP).
4. Classical Optimisation – Introduction, Single and Multi-variate problems, Lagrangean method, Karush-Kuhn-Tucker (KKT) conditions
5. Inventory modelling – Classification of inventory, Deterministic versus Stochastic problem situations, Formulation and Solution of Deterministic inventory problems,
6. Simulation – Meaning, Monte-Carlo simulation, generation of random observations, Use of digital computers in simulation, Discussion on simulation examples such as inventory, queuing etc.

Text and references
1. Operations Research – H A Taha
2. Operations Research – Gupta and Hira
3. Operations Research – Billy E Gillet
4. Operations Research – Panneerselvam
5. Optimisation – S S Rao
6. Operations Research – N G Nair
7. System Simulation by digital computers – N Deo

ME 624: ENGINEERING INSPECTION AND METROLOGY (3-1-2),(for ME &IPE)
Theory: 100 Sessional: 50 Laboratory: 50 Time: 3hours

1. **Introductory concept**: Meaning of engineering inspection and Meaning of engineering metrology. Controlling quality through inspection, types of inspection, merit/demerit of 100% inspection, Sampling inspection – Representative sample. Different methods and techniques of measurement. Standards of measurement and sub-division of standards.
2. **Statistical Process Control**: Product variations – Chance causes and assignable causes, Control charts and its significance in statistical process control, Computer implementation of control charts.
3. **Limits of size and fits**: Concept of tolerance, allowance and clearance. Natural tolerance limits, process capability and Specification limits. Hole and shaft basis systems of specifying limits of size and tolerances. Indian Standard for fits and tolerances.

Limit gauges – hole and plug gauge, Taylor's principle of gauging. Tolerances and allowances during design of gauges.

Interchangeability – its importance in production, techniques of achieving interchangeability during manufacturing.

4. **Measurement of screw threads**: Terminologies of screw threads. Measurement of various parameters of screw thread such as diameter, thread angle, effective diameter and pitch. Use of screw gauge and pitch gauge, Use of diameter and pitch measuring machines. Two and three wire methods.

   Use of Profile projectors and Tool Maker's Microscope (TMM) in the measurement of thread elements

5. **Measurement of gears**: Gear tooth profiles – involute and cycloidal, involute function. Spur gear measurements for run-out, pitch, profile, backlash. Parkinson gear tester. Measurement of tooth thickness – chordal thickness method, constant chord method, base tangent method. Check for pitch circle diameter and tooth spacing.

6. **Surface texture**: Meaning of surface texture, order of geometrical irregularities, elements of surface texture. Meaning of roughness and fineness. Roughness width cut-off. Representation of surface roughness. Estimation of surface roughness. Measurement of surface roughness by stylus equipment.

7. **Interferometry**: – Principle of interference. Use of optical flat. Gauge interferometer – Principle NPL gauge interferometer. Laser interferometer.

8. **Alignment testing:** – Optical methods for alignment testing, Laser alignment testing.

Texts and references:
1. Engineering Metrology – K J Hume
2. Engineering. Metrology – K W B Sharp
3. Engineering Metrology – R K Jain
4. Engineering metrology – M Mahajan
5. Dimensional metrology – M K Khare and S Vajpayee.

IP 633 : PLANT LAYOUT AND MATERIAL HANDLING [4-0-2]
Theory100marks Sessional50 marks Lab./ pract50 marks Time 3 Hrs

Unit I   :   Introduction Definition and objective of plant layout – problems and principle of plant layout : different types of layout.

Unit II   :   Factors in plant Layout.   Different factors   influencing   the   Layout …….man   machine. Material movement, service, building, storage etc. Analysis and co-ordination – plant layout procedure – Symptom's of bad Layout.

Unit III :   Planning and Layout   Process   planning   :   materials, building, determination of equipment cost.

     Layout fundamentals : Getting the facts, flow studies, proximity cross charts ; Flexibility and Layout aids templates. Tapes, re-production methods – Evaluation of the layout.

Unit IV :   Installing the Layout .   Plant layout procedure, plant Engineering and acceptance.

Unit V   :   Introduction to Material Handling. Objective   and   elements –   material handling activities and function, systems of bad material handling.

Unit VI   :   Material Handling Organisations. Fundamental principles. : relation to plant layout, safety in operation, traffic and Handling equipments.

     Systems of bad material handling system.

Unit VII : Material Handling Equipment. Classification and types : Conveyors, its types ;. Noists, Mobile equipments – positioning equipment , Supper equipment, selection of material handling equipments.

Unit VIII : Economics Unit load concept in material handling, systematic handling analysis : economics of material handling.

Reference books
1. Plant layout and Mmaterial Handling   ----- G. K. Agarwalla.
2. Practical Plant Layout   ------ Mather.
3. Material Handling   -------- Immer.
4. Plant Layout Design   ------ Moore.
5. Industrial Engineering and production -------- M. Telsang
   Management

IP 634 : MACHINE TOOL TECHNOLOGY [4-0-2]
Theory100 marks Sessional50 marks Lab./Pract50 marks Time 3 Hrs

Unit I : Introduction Characteristics and objectives of m/c tools – Basic features – classification, process capability and compliance, essential requirements – selection and maintenance – Efficiency, quality and Performance of a m/c tool.

Unit II : Kinematics of m/c tools. Classification and choice of driving systems. Basic considerations in the design of drives – Speed and structure program. Selection of optimum ray diagram. Transmission in the systems of stepped regulation. Spindle speed and design of all beared headstock – intermediate shaft diameter calculation.
   Stepless drives and hydraulic drive. Feed gear boxes.

Unit III : Beds, Tables and Columns Various types of beds, their materials, construction and design features ; tables design principle – stiffness and natural frequency.
   Columns -- material and design criteria.

Unit IV : M/C tool guides and Spindle. Classification and requirements of guides and spindle materials –Lubrication, kinematic Friction and stick slip vibration – Design criteria. Wearing of guides and influences of material hardness on guidewear. Temperature deformation. Effect of microstructure, chemical composition and surface preparation. Methods of calculating pressure on guides.
   Spindle units – material, construction and supports.

Unit V : Rigidity and Vibration in m/c Tools. Introduction – Static and Dynamic rigidity, forced damped, self, excited and stick slip vibration.
   Vibration isolators.

Unit VI : Testing of m/c Tools. Necessity – Alignment tests and performances tests in Lathe, drilling and milling machines – preparation of tests charts.

Unit VII : Semi Automatics and Automatics. Introduction : …tan and turrent Lathe ; principles …….. and working – comparison with engine lathe. ……….. including and bar feeding mechanism. Tooling for simple products.
   Automatic machines : Single and multi-spindle. Swiss type automatics.

Reference books
1. Principles of Machine Tools   ---------- Sen and Bhattacharya.

2. Design of Machine tools   ------   S. K. Basu.
3. Machine Tool Engineering   --------   G. R. Nagpal.
4. The Design and construction of M/C tools   ------   H. C. Town.
5. Machine Tools Design hand Books   --------   C.M.T.I.

IP 635 : COMPUTER METHODS AND DATA PROCESSING [3-1-3]
Theory100marks Sessional /Lab.50marks Time 3 Hrs

Unit I : Basic elements and use of computers – Analog and Digital, Programming and Software, Machine language.

Unit II : Machine processable data, Number system, Alphanumerical systems and organisation of data.

Unit III : Introduction to Data structures, Arrays, Lists, Stacks, Queues, Trees, Graphs, Structured programming using high level programming language. Introduction to data base management systems.

Unit IV : Introduction to data processing – processing facilities, implication for production engineering and management, Industrial and production management problems of the data processing.

Unit V : Processing equipment, computers and future developments. Application through case study.

Reference books
1. Digital Computer Fundamentals   ------   V. Rajaraman, PIH
2. Introduction to Data Structures   ------   Horowitz and Sahani, GB.
3 Introduction to Data Base Systems.   ------   C. J. Date, Addission, Wesley, 1985
4. First Course in Data Base systems   ------   Jeffrey D Ullman and Jenifer
                                         Widom, Prentice Hall, 1997

5. Data Structure, algorithm and Softaware   -----   Thomas A Standish, Addition
         principles in C   Wesley, 1995.

IP 731 : PRODUCTION PLANNING AND CONTROL [3-1-0]
Theory100 marks Sessional75marks Time 3 Hrs

Unit I : The need for production planning and control (PPC) – Functions – Production planning versus Production planning versus Production Control.

        Factors influencing PPC : Project and Jobbing production, Batch, Mass and Flow production, Continuous production – Planning for meeting seasonal or occasional increase in demand. Centralised and decentralised PPC.

Unit II : Pre-requisites of PPC : product design and analysis – marketing, functional and operational analysis ; Data for raw materials, Equipment and Tooling.

        Economic Analysis : Profit and competitiveness – standardisation and Simplification – Economic lot size.

Unit III : Process Design : Product planning or buy decision, value analysis. Process planning steps and process sheets – Routing – Tool control. Cost benefit and Break-even analysis.

        Process planning in different situations.

Unit IV : Scheduling : Concepts – Factors influencing scheduling : Master Schedule.

Job Schedules – Schedule techniques – Gantt Chart. Mathematical loading and scheduling – Index method – Sequencing.

Project Scheduling – Network logic and Steps in the use of critical Path Analysis.

Unit V   :   Dispatching : Introduction and Functions – How functions are performed – Dispatching under different situations – Documents in Dispatching.

Unit VI   :   Sales Forecasting : Need and meaning – Forecasting techniques – market survey ; Experimental smoothing ; Regression analysis, sessional variations.

Extrapolating Future Demand.

Reference books
1. Production Planning and Control (Everest Publisher) ------ L. C. Jhamb.
2. Elements of PPC (Universal Book)   ------ S. Elton.
3. Production Systems, Planning analysis and Control   ------   J. L. Riggs.

IP 732 :   ERGONOMICS AND WORK DESIGN   [3-1-0]
Theory100 marks Sessional75   marks Time 3 Hrs

Unit I   :   Introduction and definition : Main constituent areas of study – Approach to Ergonomic problem solving and Guide to Ergonomic study – Motto and responsibilities of Ergonomists.

Defining human factors in a production systems ; Characteristic features of man-machine system.

Unit II   :   Anthropometry : meaning – Body dimensions and posture – Structural and Functional Body dimensions : Design of seating – work surface height – Design for extreme individuals and average : Design for adjustable range.

Work space Design.

Unit III   : Human performance and performance reliability : Human performance under heat, cold, illumination, vibration, noise, pollution, static and dynamic conditions.

Unit IV   :   Bio-mechanics and Bio-engineering : Movements of body members – anatomical levers – Energy expenditure in body movements – Rest period.

Unit V   :   Design of Controls : Types and Examples ; Choice of control – control dynamics ; general principle.

Unit VI   :   Application of results from human factors data and analysis in work study : Work design ; Method study and work measurement techniques.

Reference books
1. Ergonomics   [AICTE, code no. 264   ]   ---------- Dr. S. Raja.
2. Work Study and Ergonomics [Dhan Pat Rai & sons] ------ H. S. Shan.
3. Industrial Engineering and Production Management   ------   M. Telsang.
                             [S. Chand & Co.]
4. Ergonomics and work Design [New Age]   ------   Nag.

IP   733 :   NON -TRADITIONAL PRODUCTION PROCESS   [3 -1-2]
Theory100 of marks Sessional/Lab75 marks Time 3 Hrs

Unit I   : Introduction to the new methods of Production, Need and capability analysis of the various processes ; classification and selection.

Unit II : Abrasive processes of machining : Abrasive Jet Machining (AJM), Water Jet Maching (WJM) and ultrasonic Machining (USM). Equipments and the processes ; advantages and Application.

Unit III : Chemical Machining (CHM) and Electro-chemical, Machining (ECM) : Principle and steps in the process ; merits, demerits and application. Electro-chemical deburring and Honing. Electro-Chemical Grinding (ECG).

Electrical Discharge Mechnining (EDM). Principle of the process ; the EDM machine and tools. Field of application. Comparison with ECM.

Unit IV : The principle and process of Electron Beam Machining (EBM), Plasma Arc Machining (PAM) and Laser Beam Machining (LBM). Comparative study of the processes and applications.

Unit V : High Energy Role Forming (HERF) or High Velocity Forming (HVF) -- Explosive Forming, Electrohydraulic Forming, Magnetic Forming and Pneumatic Mechanical Forming. Principle, steps and application.

Unit VI : **S**election of the most suitable process for a products. Economic analysis of the non-traditional machining processes.

Reference books

1.

2.

IP 734 : ORGANISATIONAL BEHAVIOUR AND INDUSTRIAL RELATIONSHIP [3-1-0]

Theory-100marks Sessional-75marks Time 3 Hrs

Unit I : Introduction : Concept and features of organisation. Types and signature – concept of organisational behaviour (OB) : Nature and role of O.B. – value of Theory and experience – Applying OB knowledge to management practices ; Hawthorne experiments.

Unit II : Motivation and behaviour – Human needs and classification : Maslow's Need Priority Model and Need Hierarcht.

Theory X and Theory Y : Expectancy Theory of approach. Financial and non-fianacial incentives. Job enrichment.

Concept and nature of Attitudes – attitudes formation, measurement and change.

Unit III : Group Dynamics and behaviour : Concept – Nature and types of group : Group behaviour, norms, cohesion and decision making. Positive and negative aspect of group decision making.

Conflict management : meaning and definition – stages of conflict situation. Conflict resolutions and implication.

Unit IV : Leadership Qualities : meaning and definition – importance and functions of leadership ; leadership styles ; Theories of leadership. Factors affecting managers as leaders.

Power and Authority : Need for control ; control and organisational factors ; Means of Control. Power distribution in organisation ; Authority and its sources, Limits of authority. Power and authority comparison.

Unit V **:** Organisational Developments (O.D.) : Objectives and values O.D. ; characteristics of O.D. ; process involved in O.D. and the variance training methods used.

Human Resources developments.

Unit VI **:** Participative Management : Idea, advantages and Limitations of participation ; Theories of participation. Participative management : Morale and productivity. Determinants and degree of participation.

Unit VII **:** Industrial Relations : Indian Trade Union act, Industrial Dispute act and Indian Factories act.

Industrial disputes Settlement machinery in India – Works committee, Conciliation officers, Board of Conciliation, Court of inquiry, Industrial Tribunal, Adjudication.

Payment of Wages act : Workmen's compensation act.

Reference books

1. Organisational Behaviour : Concepts, ------ Stephen P. Rabins.
    Controversions and application (PHI)
2. Organisational Behaviour (S. Chand & Co.) ------ L.M. Prasad.
3. Organisational Behaviour (King Books) ------ M.M. Varma anf R. K. Agarwal.
4. The Industrial Law (Eastern Book Co) ------ P. L. Malik
5. Personal Management and Industrial ------ R. S. Davar.
    Relations in India. (Vikash)
6. Labour and Industrial Laws. (Pioneer Printers) -- R. K. Agarwal and A.K. Gayal.

IP 735 (Elective I) : ECOLOGY AND ENVIRONMENT [3-1-0]
Theory -100 marks Sessional -75 marks Time 3 Hrs

Unit I **:** Basic concept of Ecology and Environment : Subdivision of Ecology – Basic components of Environment – impact of major technological developments.

Ecosystems – Components and functioning – concept of Homeostatis – Natural , man made and agroecosystems.

Impact of Biosphere on the Environment.

Unit II **:** Earth's Natural Resources – Soil, Water, Forest, Wildlife etc.: Renewable and non-renewable resources – Finite nature of the natural resources – basic human requirements – overexploitation of the resources ; towards sustainable developments.

Unit III **:** Environmental pollution – Effects of Pollutants on living systems : Air, Water, Agricultural Noise and Radiation pollution – Solid waste and Hazardous substances.

Monitoring and Control.

Unit IV **:** Environment and Future : Global warming causes and Effects.

Pollution growth – regulation ; Modern Technology and Population explosion ; World Food Production – population growth in India – Green revolution.

Growth and Urbanisation : factors contributing to urbanisation – urban environment – health housing, Education etc. – management of urbanisation.

Unit V **:** Environmental Imapact Assessment process – Goals, Objectives, Survey, Prediction and analysis ; alternative plans – implementation and monitoring. Cost benefit analysis.

Environment and sustainable developments with regard to population growth, Global warming, Urbanisation and Industrial growth – Threat to sustainable development – development project and nature management.

Reference books

1. Environmental Problems and solution (S. Chand & Co.) ----- D. K. Asthana and
Meera Asthana.
2. Fundamentals of Environmental Science (Kalyani Publ.) ----- G. S. Dhaliwal, G.S.
Sinha and P. K. Rathen.
   3. Environmental Engineering (Tata Mc Graw Hills)---- G. N. Pandey & G. C. Carney.

IP 736 (Elective II) : TOTAL QUALITY MANAGEMENT [3-1-0]
Theory-100 marks Sessional-75 marks Time 3 Hrs

Unit I : Introduction : Concept of quality : Quality of design Conformance and Performance – Inspection and Quality Control (Q.C.) cost and value of Q.C. – Statistical Quality Control (S.Q.C.) – Benefits.
       Total Quality Control (T.Q.C.) -- meaning and evolution.
Unit II : Concept and definition of Total Quality Management (TQM) : Characteristics feature – stages in TQM ; Pre-requisites and Lavels of TQM – Methodology for implementation.
       TQM concept and practice in India.
Unit III : The Structure of TQM – Quality checkpoints – stages of Product's life and associated quality control – structural Elements of TQM..
Unit IV : The operational Dimensions of TQM. Creating a co-ordinating structure for TQM activities – Quality improvement and Quality policy – Training for TQM activities.
       Quality Control Circles (QC^2) : Variations and characteristics – Establishing QC^2.
       Objectives, standards and measures for TQM.
Unit V : Implementation of TQM : Scope and pre-conditions – Planning for implementation – guidelines and steps – Juran's Methodology for Quality Planning.
Unit VI : Problems in TQM implementation – Impending factors and supportive measure -- Integration for TQM ; Proactive and Reactive approach.
       ISO : 9000 -- A way to TQM.
Reference books
1. Total Quality Management : Theory practice [AICTE]------ Dr. P.N.Rastogi.
2. T.Q.M. & ISO : 9000 [AICTE publication]   ------ Dr. P.L. Bali.
3. Statistical Quality Control [Dhan Pat rai & Sons]   ------ M. Mahajan.

IP 737L: PRACTICAL TRAINING(0-0-2)
Sessional: 50marks

       Factory training for a period of 6 (six) weeks is compulsory for all the Industrial and Production Engineering Students and 20 marks are allotted for the Technical report submitted after completion of the training. There will be a seminar cum viva on the report submitted by the student and 30 marks are assigned for this. The report should be submitted to the HOD, by a date announced by the HOD. Students are to obtain a certificate from the Factory Authority regarding their attendance and performance during the training period which is to be submitted along with the report.

IP 738L: PROJECT – I(0-0-8)
Sessional marks: 100 Pass   marks: 50

Under this course each student will be assigned a topic related to Industrial and Production Engineering. The project may be extended to Eight semester depending upon the quantum of works required for the project. The students will work under a faculty member and submit a report on the assigned project in a standard FORMAT prescribed by the department.

IP 831 : COMPUTER AIDED DESIGN AND MANUFACTURING [4-1-0]
Theory -100 marks Sessional-75   marks Time 3 Hrs

Unit I   : Concept of CAD / CAM --- Computer system and related Technology : selection of Computer,   CAD/CAM   hardware and System, Computer Languages. CAD/CAM Fundamental and Operating software.

Unit II   : Computer Graphics and Modelling – Software Configuration, Geometric and solid Modelling,   Building block for Solid, Wire frame Modelling – Finite element Analysis. Database Management – Databank Concept, CAD/CAM Databases – Databank Information Storage and retrieval, Data life Cycle – integrated data Processing.

Unit III   : Numerical Control and Part Programming --   Growth development and Component in NC system – Operation of an NC machine tools system – Co-ordinate system – Binary System – Basic motions of NC System. CNC system – CNC-DNC and adaptive Control. Justification and Economics – Part programming and Computer Languages.

Unit IV :   Group Technology and FMS – Concept of Group Technology, Process Planning and Group technology, benefits of Group Technology. Definition and concept of of FMS -- Work Stations – Planning, different Types and Technology required for FMS – justification.

Unit V   :   Computer Integrated Manufacturing Systems (CIM) – elements of CIM – approach to CIM and Steps – Planning and Implementation – Material requirement planning, Capacity Planning – Shop floor Control. Role of Management in CIM.

Reference books
1. CAD/CAM   (Dhan Pat Rai & Sons.)   ------ S. Kumar and A.K. Jha
2. Computer Integated Manufacturing (PHI)   ------ S. K. Vajpayee.
3. Mechatronics, HMT Ltd., (Tata Mc Graw Hills) .

IP 832 : DESIGN OF JIGS, FIXTURE AND PRESS TOOLS [3-1-0]
Theory -100 marks Sessional-75   marks Time 3 Hrs

Unit I   : Introduction : Classes of Engineeirngproduction – Definition and functions of Jigs and fixtures.

Principles of location – Locator Types, clamping principles – Types of clamp : Drill bushes and plate – bush types and materials.

Design considerations.

Unit II   : Design of Drill Jigs : Types, Jigs and Machine relationship. Jig body and feet. Examples of typical drill Jigs.

Design for specific product.

Unit III : Design of Fixtures : Types, Fixture and machine relationship – Examples of typical milling fixtures – Design.

Turning, Grinding and broaching fixtures.

Unit IV : Press Tools : Types of Presses ; Press Tool operations – Computation of capacities and tonnage for blanking, Piercing, bending, forming and drawing operations.

Principle and design procedure for press tools. Detailed designing procedure for bencing and planking operations examples.

Unit V : Dies : types – Combination and progressive die ; Single, double and triple action dies.

Detailed design procedure for blanking and piercing dies with examples.

Reference books
1. Production Tooling Equipment (B.I. Publication)   ------ S.A.J. Parsons.
2. Fundamentals of Tool design (PHI)   ------ A S T M E.
3. Jigs and Fixture (Jain Brothers)   ------ Griant.
4. Jigs and Fixture (TATA McGraw Hill)   ------ Joshi
5. Press Tool : Design and Calculation   ------ P. H. Joshi
         (A.H. Wheeler % Co.)

IP 833 : MATERIALS MANAGEMENT [3-1-0]
Theory -100 marks Sessional-75 marks Time 3 Hrs

Unit I : Definition, Importance and Objective – Integrated Material management ; Organisation and control ; Codification – requirement, Types and method.

Simplification and standardisation.

Unit II : Material requirement Planning (MRP) : Principle, Pre-requisites, Assumptions – MRP systems and Logic. Materials Budget – Techniques and preparation – Forecasting Techniques and guidelines.

Value Engineering : definition, scope and Techniques of value Analysis ; value analysis and value Engineering, steps and principles.

Unit III : Inventory Control : Functions, classification, determining Inventory levels, Inventory Models and Costs – EOQ – optimum lot size – Economic lot size. ABC analysis and classification – Class A, B and C items – Objective – Limitation of ABC analysis.

Unit IV : Store Keeping : Functions and Organisation – Centralised and de-centralised systems – Role of Store Keeper, essentials of good store keeping. Precaution and security measures in store room. Receipt of Materials – Checking Quality and Quantity ; Damage / Storage Report. Use of Bin Cards and Stock register. Inspection of incoming materials – Identification of stores – Material Coding. Store Accounting.

Unit V : Purchasing : Organisation, Duties, Centralised and decentralised Purchasing – Purchasing Officer – Sources of supply and supplier selection, Buyer – Seller relationship and ethics --- Buying locally and reciprocal buying – Single and multiple source.

Legal aspects in buying.

Unit VI : Purchasing procedure and record : Purchase classification – Requisition, purchase order, follow up and expediting systems. Receipt and inspection.

Records of Purchase – contract, quotation, vendors, records – summary of purchase work and miscellaneous records.

Import procedures and documents.

Reference books

1. Materials Management (AICTE : Code No. 333) -----   K. C. Sahu.
2. Materials Management (Forward book depot)   ------   C. B. Agarwal.
3. Integrated Materials Management   ------   Gopala – Krishna.
       (Tata McGraw Hills)
4.   Purchasing and Materials Management (Tata McGraw Hill) ----   Lee Dobler.

IP 834 (Elective III) :   INDUSTRIAL MARKETING   [3-1-0]
Theory -100 marks Sessional-75   marks Time 3 Hrs

Unit   I   : Basic Consideration : Concept, nature and scope of Industrial marketing management and marketing functions, Planning : Annual Plan ; element of marketing mix, Factors affecting marketing mix – variable relating to market.

Unit II   :   Market segmentation : Definition and Importance – types – product oriented market segmentation, criteria for segmenting a market. Marketing Information system, Information needs of Marketing Executive – Information based decision making.

Unit III   :   Marketing Research : meaning, aims and objectives – organisation of research groups – sources of marketing research and technique : Questionnaire and marketing research, steps designing and questionnaire. Marketing research and market research.

Unit IV   :   Consumer behaviour ; demand for goods, buying decision process, buyers behaviour Models. Buying motives, Motivation research Techniques : Buyer and Seller relationship – decision making theories in brief – decision making model and procedure. Marketing Environment.

Unit V   :   Advertising and Sales promotion : Role and importance of advertising in selling – social responsibilities in advertising – advertising methods – product branding, packaging and labelling. Sales promotion management – Personal selling – sales forecasting. Industrial marketing control.

Unit VI   : Pricing :   Strategy and decision : Conditions affecting Price – Pricing policies : Cost analysis and pricing – pricing methods --   price discrimination. Evaluation of Marketing performance.

<u>Reference books</u>
1. Marketing Research (King's Book)   ------   M.M. Verma and R.K. Agarwal.
2. Element of Marketing Management (KedarNath, RamNath)----   P. Kumar.

IP 835 (Elective IV) :   PROJECT PLANNING AND APPRAISAL   [3-1-0]
Theory -100 marks Sessional-75   marks Time 3 Hrs

Unit I   :   Introduction – Concept of Project – Characteristics and classification – aspect of project : Project identification – selection criteria and feasibility analysis. Project Formulation – Steps – Planning and Evaluation.

Unit II   : Project appraisal : Concept and scope – stages in project appraisal – appraisal criteria and Methodology.

Unit III : Financial analysis and Project Finance : significance of Financial analysis ; Financial Tools – preparation of fund flow statement, Cash flow measurement ; ratio analysis – Advantages and limitations – Break-Even analysis. Project Financing – Sources.

Unit IV : Analysis of Project Networks -- PERT and CPM -- Network representation – Rules to setup Networks – Analysis. Structuring of PERT Data – Arrow diagram, Work break down structure.

Unit V : Project Monitoring and control Aspects ; Project Management under risk and uncertainty – using computer for project management. Towards better project management – Bottlenecks and remedies.

Reference books
1. Project Management (Himalaya Publishing house) ------ V. Desai.
2. Project Management (Code No. 129, AICTE) ------ K. C. Sahu.
3. Project Management with PERT, CPM etc. (Jain Brothers) ---- J.C. Pant.

IP 835 (Elective IV) : MANAGEMNET INFORMATION SYSTEMS [3-1-0]
Theory -100 marks Sessional-75 marks Time 3 Hrs

Unit I : Management Information System (MIS) ; Concept, role and impact – organisation – Information characteristics ; Taxonomies of information systems. Structure and developments of MIS – Effectiveness.

Unit II : MIG basics -- Decision making concept and MIS : organisation and information, MIS and information : System concept and control : MIS and system concept : System analysis and MIS.

Unit III : Development of MIS – Long range plans ; class of information and requirement. Implementation of MIS – Procedure, evaluator ; Management of Quality in MIS.

Unit IV : Technology of information system -- data, transaction and application processing ; TQM for information systems : Human factors and user interface.
Real time systems and design.

Unit V : Database Management System – concept, models and design---Conceptual and Physical model. Performance monitoring. MIS AND RDBMS.

Unit VI Application of MIS in manufacturing and service sectors. Enterprise management system(EMS)---Enterprise resource planning(ERP). EMS and MIS.

Reference books
1. Management Information Systems (Tata McGraw Hill) ------ W.S. Jawadakar.
2. Management Information Systems (BFB Publication) ------ T. Lucey
3. Management Information Systems (Code No. 489, AICTE)----- D.F. Goyal.

IP 836L: PROJECT – II (0-0-120

Sessional marks: 150 Passmarks: 75

Under this course the students are required to submit a project report on Industrial &Production Engineering topics. The report should be submitted in a standard FORMAT prescribed by the department .

IP 837L: VIVA – VOCE
Total marks: 75 Pass marks :   38

A final semester viva voce examination will be held at the end of I.P.E.8th semester examination. The viva voce will be to assess the student on his/her overall knowledge of the subjects related to Industrial and Production Engineering in addition to the project works he/she had undertaken in 7th and 8th semester.