

## B. TECH. [ INDUSTRIAL & PRODUCTION ENGINEERING ]

### SECOND YEAR : SEMESTER -III

S. No.	Course Code	SUBJECT
THEORY		
1.	IPE 301	Mathematics –III
2.	IPE 302	Engineering Materials
3.	IPE 303	Manufacturing Processes
4.	IPE 304	Fluid Mechanics & Machinery
5.	IPE 305	Strength of Material

IPE 301	Mathematics –III
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#### Unit - I : Integral Transforms

Fourier integral, Fourier complex transform, Fourier sine and cosine transforms and applications to simple heat transfer equations.

Z – transform and its application to solve difference equations.

#### Unit - II : Functions of a Complex Variable - I

Analytic functions, C-R equations and harmonic functions, Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions, Liouville's theorem, Fundamental theorem of algebra.

Representation of a function by power series, Taylor's and Laurent's series, Singularities, zeroes and poles, Residue theorem, evaluation of real integrals of type  $\int_0^{2\pi} f(\cos\theta, \sin\theta) d\theta$  and  $\int_{-\infty}^{+\infty} f(x) dx$ , Conformal mapping and bilinear transformations.

#### Unit - III : Statistics and Probability

Moments, Moment generating functions, Skewness, Kurtosis, Correlation and Regression, Binomial distribution, Poisson distribution, Normal distribution.

#### Unit - IV : Curve Fitting and Solution of Equations

Method of least squares and curve fitting of straight line and parabola, Solution of cubic and bi-quadratic equations.

IPE 302	ENGINEERING MATERIALS
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**Unit – I : METALLIC MATERIALS:** Concept of malleability, ductility, toughness, fatigue resistance and other properties, mechanical and non destructive tests of metals. **Pig iron:** production and uses. **Cast iron:** production, types, uses and effects of impurities. **Steels:** Bessemer and open hearth steel production and uses; Plain carbon and different types of alloy steels. Bearing metals, light alloys, common metals and their alloys.

**Unit – II : FE-C EQUILIBRIUM DIAGRAM.** Different types of Heat treatment processes (annealing, normalizing quenching etc). Case hardening, carburizing and nitriding and induction hardening. Inspection of metals. Powder Metallurgy. Composite Materials

**Unit – III : NON-FERROUS METALS AND ALLOYS :** Non-ferrous metals such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various type Brass, Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin. Other advanced materials/alloys.

**Unit – IV : CERAMICS, PLASTICS & OTHER MATERIALS :** Structure types and properties and applications of ceramics. Mechanical/Electrical behaviors and processing of Ceramics. Various types of polymers/plastics and its applications. Mechanical behavior theoretical consideration of Fracture, Fatigue, and Corrosion and its control.

<b>IPE 303</b>	<b>MANUFACTURING PROCESSES</b>
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**Unit – I : Classification of manufacturing processes,** Casting: casting processes for ferrous and non ferrous metals, sand, die, centrifugal, slush, plaster mould, loam mould, precision investment casting etc., casting defects, design of moulds, riser, runner, gate spur and core, cost analysis.

**Unit – II : Joining Methods:** soldering, brazing, welding, conventional welding processes, Gas, Arc, TIG, MIG, Termite, resistance, Friction, Electro slag etc. Special welding processes: LASER, Electron Beam, Submerged Arc welding etc.,

**Unit – III : Precision and non-precision surface finishing operation. Hot and cold working processes:** Hot and cold extrusion, press-working operations etc. rolling, cold drawing, deep drawing, forging, shearing, bending and press work. **Sheet Metal working :** Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs Piercing. Compound vs Progressive die. Flat-face vs Inclined-face punch and Load(capacity) needed. Analysis of forming process like cup/deep drawing and bending

**Unit – IV : Metal Forming Processes :** Elastic & plastic deformation, yield criteria. Hot working vs cold working. Load required to accomplish metal forming operation. Analysis (equilibrium equation method) of forging process with sliding friction sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging Analysis of Wire/strip drawing and max. reduction, Tube

drawing, Extrusion and its application. Condition for Rolling force and power in rolling. Rolling mills. Design, lubrication and defects in metal forming processes.

<b>IPE 304</b>	<b>FLUID MECHANICS &amp; MACHINERY</b>
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**Unit – I : Fluid properties, Fluid Static:** Viscosity, Compressibility, Surface Tension, Capillarity, Vapour Pressure; Cavitation, Pascal's law; Pressure-density-height relationship; Measurement of pressure by Manometers and mechanical gauges; Pressure on plane and curved surfaces; The Hydrostatic law; Total Pressure and Centre of pressure; Buoyancy; Stability of immersed and floating bodies; Manometer;

**Unit – II : Fluid Dynamics :** Impulse-Momentum Principle; Moment of momentum equation; Momentum equation application to stationary and moving vanes, pipe bends, Problems related to, combined application of energy and momentum equations, flow measurements, determination of coefficients of discharge, velocity and contraction and energy loss.

**Unit – III : Classification of Fluid Mechanics,** Application of momentum and momentum equation to flow through hydraulic machinery, Euler's fundamental equation. **Hydraulic Turbine :** Classification of turbines, Impulse turbines, constructional details, velocity triangles, power and efficiency calculations, governing of Pelton wheel. Francis and Kaplan turbines, constructional details, velocity triangles, power and efficiency calculations, degree of reaction, draft tube, cavitation in turbines, principles of similarity, unit and specific speed, performance characteristics, selection of water turbines.

**Unit - IV : Pumps : Centrifugal Pumps:** Classifications of centrifugal pumps, vector diagram, work done by impeller, efficiencies of centrifugal pumps, specific speed, model testing, cavitations and separation, performance characteristics. **Positive Displacement Pumps:** Reciprocating pump theory, slip and coefficient of discharges, indicator diagram, effect and acceleration, work saved by fitting air vessels, comparison of centrifugal and reciprocating pumps, positive rotary pumps, Gear and Vane pumps, performance characteristics.

<b>IPE 305</b>	<b>STRENGTH OF MATERIAL</b>
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**Unit – I : Stress Analysis:** Statically indeterminate axially loaded member, Axially loaded member, thermal and centrifugal stresses, Review of simple and compound stresses, Mohr's Circle, 3-D Stress, Theory of failure, Impact load: Three-dimensional state of stress & strain, equilibrium equations. Generalized Hook's Law.

**Unit – II : Stresses in Beams:** Review of pure Bending. Direct and shear stresses in beams due to transverse and axial loads, composite beams. shear force and

bending moment diagrams **Deflection of Beams:** Equation of elastic curve, cantilever and simply supported beams, Macaulys method, area moment method, fixed and continuous beams. **Torsion:** Review of Torsion, combined bending & torsion of solid & hollow shafts

**Unit – III : Columns and Struts:** Combined bending and direct stress, middle third and middle quarter rules. Struts with different end conditions. Euler's theory and experimental results, Ranking Gordon Formulae, Examples of columns in mechanical equipments and machines.

**Thin cylinders & spheres:** Hoop and axial stresses and strain. Volumetric strain.

**Thick cylinders:** Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, Compound cylinders. Stress due to interference fits

**Unit - IV : Curved Beams:** Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression. **Unsymmetrical**

**Bending :** Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel-section.