

INDUSTRIAL AND PRODUCTION ENGINEERING SYLLABUS

Section 1: General Engineering

Engineering Materials: Engineering materials (metals, ceramics, polymers and composites) – properties and applications; stress-strain behavior of metals and alloys; iron-carbon phase diagram, heat treatment of metals and alloys, its influence on mechanical properties, testing and inspection of metal (Hardness, impact, tensile, creep, non-destructive testing, etc).

Strength of Materials: Stress, strain and their relationship; failure theories, Mohr's circle(stress), deflection of beams, bending and shear stress, Euler's theory of columns.

Mechanics, Theory of Machines and Design: Equilibrium of forces, Analysis of planar mechanisms, governors and fly wheels, gears and gear train; design of riveted and welded joints; design of shafts, keys, belt drives.

Thermal and Fluids Engineering: Fluid statics, Bernoulli's equation, first and second law of thermodynamics, thermodynamic system and processes, air standard cycles; heat transfer – basic applications of conduction, convection and radiation.

Section 2: Manufacturing Processes I

Casting: types of casting processes and applications; patterns – types and materials; allowances; moulds and cores – materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys.

Metal Forming: Hot and cold working – forging, rolling, extrusion and wire drawing; sheet metal working processes – blanking, bending and deep drawing; metal working defects.

Joining of materials: Principles of fusion welding processes (metal arc, MIG, TIG)–different heat sources (flame, arc, resistive, laser, electron beam), and heat transfer and associated losses, flux application, feeding of filler rod; Principles of solid state welding processes (friction, explosive welding, ultrasonic welding processes); Origins of welding defects; welding techniques.

Section 3: Manufacturing Processes II

Machine Tools and Machining: Basic machine tools like centre lathe, milling machine, and drilling machine – construction and kinematics; machining processes - turning, taper turning, thread cutting, drilling, boring, milling, gear cutting, thread production, grinding; geometry of single point cutting tools, chip formation, cutting forces, specific cutting energy and power requirements.

Section 4: Quality and Reliability

Metrology and Inspection: Limits, fits, and tolerances, gauge design, interchangeability, selective assembly; linear, angular, and form measurements(straightness, squareness, flatness, roundness, and cylindricity) by mechanical and optical methods; inspection of screw threads and gears.

Quality management: Quality – concept and costs; quality assurance; statistical quality control, acceptance sampling, zero defects, six sigma; total quality management; ISO 9000.

Section 5: Industrial Engineering

Product Design and Development: Principles of good product design, product life cycle; standardization, simplification, diversification, value engineering and analysis, concurrent engineering; comparison of production alternatives, batch, job, mass production.

Facility Design: Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling systems.

Section 6: Operations Research

Operation Research: Linear programming – problem formulation, simplex method, duality and sensitivity analysis; transportation and assignment models; queuing models.

Engineering Economy and Costing: Elementary cost accounting and methods of depreciation; break-even analysis, techniques for evaluation of capital investments, financial statements, time-cost trade-off.