

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; fatigue strength, SN diagram.

Thermal and Fluids Engineering: Fluid statics, Bernoulli's equation, thermodynamic zeroth, 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; analysis of solidification; design of gating and riser; origin of defects.

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, plasma arc, submerged arc welding processes) – 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); Principles of adhesive, brazing and soldering processes; Origins of welding defects; welding techniques.

Powder Metallurgy: Production of metal/ceramic powders, compaction and sintering of metals and ceramic powders.

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, Merchant's analysis; basis of selection of machining parameters; tool materials, tool wear and tool life, economics of machining, thermal aspects of machining, cutting fluids, machinability;

Jigs, fixtures and Press tool – principles, applications, types and design, location and locating devices, bushing types and applications (linear, renewable, etc) and clamps; Press and Die assembly, press components, progressive, compound, transfer dies.

Non-traditional Manufacturing: Principles, applications, effect of process parameters on MRR and product quality of non-traditional machining processes – USM, AJM, WJM, AWJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM. Computer Integrated Manufacturing: Basic concepts of CAD – geometric modeling, CAM – CNC drives and controls, Group Technology and its applications – CAPP, cellular manufacturing and FMS.

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; surface finish measurement by contact and non-contact methods; tolerance analysis in manufacturing and assembly.

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

Reliability and Maintenance: Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR; preventive maintenance and replacement.

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.

Work System Design: Taylor's scientific management, Gilbreth's contributions; productivity – concepts and measurements; method study, micro-motion study, principles of motion economy; work measurement – time study, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration.

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 and Operations management

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.

Production planning and control: Forecasting techniques – causal and time series models, moving average, exponential smoothing, trend and seasonality; aggregate production planning; master production scheduling; routing, scheduling and priority dispatching, Gantt chart

Material Management: MRP and MRP-II; ABC analysis, push and pull production systems, concept of JIT manufacturing system; supply chain management; Inventory – functions, costs, classifications, inventory models, EOQ, safety stock, lead time; purchasing procedures, limited and single tendering; store keeping documents, FIFO, LIFO.