

## **Mechanical Engineering**

**Production Engineering:** Metal Cutting, Metal Forming, Welding, Metal Casting, Material Characterization, Non-traditional Manufacturing Processes, Measurements & Metrology, Grinding of Ceramics and Metal Matrix Composites, Powder Metallurgy, Microcellular Injection Moulding, Finite Element Applications in Manufacturing, CAD/CAM, Rapid Prototyping, Manufacturing Automation, Additive manufacturing, Laser material processing,

**Fluid Mechanics and Thermal Sciences Fluid Mechanics:** Fluid properties; fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings.

**Heat-Transfer:** Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan- Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

**Thermodynamics:** Thermodynamic systems and processes; properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

**Applied Thermal Engineering:** Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines

**Engineering Materials:** Structure and properties correlation; engineering materials (metals, ceramics, polymers and composites) – properties and applications; stress-strain behaviour of metals and alloys; iron-carbon phase diagram, heat treatment of metals and alloys, its influence on mechanical properties, stress-strain diagrams for engineering materials.

**Mechanics of Materials:** Stress and strain, elastic constants, Poisson's ratio; failure theories; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

**Theory of Machines:** Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope. governors and fly wheels; design of bolted, riveted and welded joints; interference/shrink fit joints; design of shafts, keys, spur gears, belt drives, brakes and clutches; pressure vessels. Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

**Machine Design:** Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements- bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

**Industrial Engineering:** Quality, Reliability and Maintenance, Lean Manufacturing, Time study, Motion study, Agile Manufacturing, Statistical quality control, Operations Management, Project Management, Supply Chain Management, Reverse Logistics, Inventory management

**Operations Research:** Linear Optimization Models, Assignment and Transportation Models, Queuing Theory, CPM/PERT