Discipline: Mechanical Engineering

Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

Engineering Materials: Structure and properties of engineering materials and their applications, heat treatment, stress-strain diagrams for engineering materials.

Strength of Materials: Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders, thick-walled vessels; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular members; columns and struts; strain energy and impact loading; thermal stresses; Rotating Rims & Discs; Bending of Curved Bars.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms, kinematic synthesis of mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels; static and dynamic force analysis; balancing of rotating components; governors.

Thermodynamics: Thermodynamic system and processes; Zeroth, First and Second laws of thermodynamics;; Carnot cycle. irreversibility and availability; behaviour of pure substances, ideal and real gases; calculation of work and heat in ideal and real processes; Rankine and Brayton cycles with modifications, analysis of thermodynamic cycles related to energy conversion; vapour refrigeration cycle, heat pumps, gas refrigeration, reverse Brayton cycle;

moist air: psychrometric chart, basic psychrometric processes.

Energy Conversion: Fuels and combustion; high pressure steam boilers; flow through nozzles; Gas turbines with intercooling, reheat and regenerators, Steam turbines, velocity diagram, power output and efficiency, maximum blade efficiency of single stage impulse turbine, blade friction, compounding of impulse turbine; reaction turbine, degree of reaction, velocity diagram, power output,efficiency; losses in steam turbines, stage efficiency, overall efficiency and reheat factor; governing of steam turbines; steam condensers, condenser vacuum, sources of air leakage & its disadvantages.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heattransfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc.

Vibrations: Free and forced vibration of single degree of freedom systems; effect of damping; harmonically excited and transient vibrations; introduction to multi-degree of freedom systems; vibration isolation; resonance, critical speeds of shafts.

Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, keys, couplings, brakes and clutches; Selection of Materials.

Fluid Machines: Pelton, Francis, propeller and Kaplan turbines; performance characteristics and governing of hydraulic turbines; introduction to Deriaz and Bulb turbines; selection of turbines; Centrifugal & axial pumps and fans, reciprocating pumps.

Joining: Chemistry of welding, design of welding joints, pre- and post-heat treatment of welded joints; brazing and soldering; adhesive bonding.

Machining and Machine Tool Operations: Mechanics of metal cutting and chip formation, single and multi-point cutting tools, tool geometry and materials, tool life and wear;principles of non-conventional machining processes; principles of work clamping, principles of design of jigs and fixtures.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools. 16. Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning.

Inventory Control: Deterministic and probabilistic models; safety stock inventory control systems, economic order quantity.

Operations Research: Linear programming, simplex and duplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

Product Design and Development: Principles of good product design, tolerance design; quality and cost considerations; product life cycle; standardization, simplification, diversification, value engineering and analysis, concurrent engineering.

Industrial Safety: Introduction, types of accidents, causes and common sources of accidents, methods of safety, first aid.

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

Management Information System: Value of information; information storage and retrieval system – database and data structures; knowledge based systems.