1. ENGINEERING MATHEMATICS

Linear Algebra: Algebra of matrices, system of linear equations, eigenvalues and eigenvectors.

Calculus: Taylor Series, Fourier Series, partial derivatives, total derivatives, definite and improper integrals, multiple integrals.

Vector Calculus: Gradient, divergence and curl, line and surface integrals, Green, Gauss and Stokesï¿½ theorems.

Differential Equations: Linear ODEï¿½s, first order non-linear ODEï¿½s, initial and boundary value problems, Laplace transform, PDEï¿½s-Laplace, wave and diffusion equations.

Numerical Methods: Solution of system of linear equations, interpolation, numerical integration, Newton-Raphson method, Runge-Kutta method.

Probability & Statistics: Gaussian, Weibul distribution and their properties, method of least squares, regression analysis, analysis of variance.

2. APPLIED MECHANICS AND DESIGN

Engineering Mechanics: Equivalent force systems, free-body concepts, equations of equilibrium, trusses and frames, virtual work and minimum potential energy. Kinematics and dynamics of particles and rigid bodies, impulse and momentum (linear and angular), energy methods, central force motion.

Strength of Materials: Stress and strain, stress-strain relationship and elastic constants, Mohrï¿½s circle for plane stress and plane strain, shear force and bending moment diagrams, bending and shear stresses, deflection of beams torsion of circular shafts, thin and thick cylinders, Eulerï¿½s theory of columns, strain energy methods, thermal stresses.

Theory of Machines: Displacement, velocity and acceleration, analysis of plane mechanisms, dynamic analysis of slider-crank mechanism, planar cams and followers, gear tooth profiles, kinematics and design of gears, governors and flywheels, balancing of reciprocating and rotating masses.Vibrations: Free and forced vibration of single degree freedom systems, effect of damping, vibration isolation, resonance, critical speed of rotors.

Design of Machine Elements: Design for static and dynamic loading, failure theories, fatigue strength; design of bolted, riveted and welded joints; design of shafts and keys; design of spur gears, rolling and sliding contact bearings; brakes and clutches; belt, ropes and chain drives.

3. FLUID MECHANICS AND THERMAL SCIENCES

Fluid Mechanics: Fluid properties, fluid statics, manometry, buoyancy; Control-volume analysis of mass, momentum and energy, fluid acceleration; Differential equation of continuity and momentum; Bernoulliï¿½s equation; Viscous flow of incompressible fluids; Boundary layer, Elementary turbulent flow; Flow through pipes, head losses in pipes, bends etc.

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 heat transfer, 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.

Thermodynamics: Zeroth, First and Second laws of thermodynamics; Thermodynamic system and processes; Irreversibility and availability; Behaviour of ideal and real gases, Properties of pure substances, calculation of work and heat in ideal processes; Analysis of thermodynamic cycles related to energy conversion; Carnot, Rankine, Otto, Diesel, Brayton and Vapour compression cycles.

Power Plant Engineering: Steam generators; Steam power cycles; Steam turbines; impulse and reaction principles, velocity diagrams, pressure and velocity compounding; Reheating and reheat factor; Condensers and feed heaters.I.C. Engines: Requirements and suitability of fuels in IC engines, fuel ratings, fuel-air mixture requirements; Normal combustion in SI and CI engines; Engine performance calculations.

Refrigeration and air-conditioning: Refrigerant compressors, expansion devices, condensers and evaporators; Properties of moist air, psychrometric chart, basic psychometric processes.

Turbomachinery: Components of gas turbines; Compression processes, Centrifugal and Axial flow compressors; Axial flow turbines, elementary theory; Hydraulic turbines; Euler-Turbine equation; Specific speed, Pelton-wheel, Francis and Kaplan turbines; Centrifugal pumps.

4. MANUFACTURING AND INDUSTRIAL ENGINEERING

Engineering Materials: Structure and properties of engineering materials and their applications, heat treatment.

Metal Casting: Casting processes (expendable and non-expendable) -pattern, moulds and cores, Heating and pouring, Solidification and cooling, Gating Design, Design considerations, defects.

Forming Processes: Stress-strain diagrams for ductile and brittle material, Plastic deformation and yield criteria, Fundamentals of hot and cold working processes, Bulk metal forming processes (forging, rolling extrusion, drawing), Sheet metal working processes (punching, blanking, bending, deep drawing, coining, spinning, Load estimation using homogeneous deformation methods, Defects). Processing of Powder metals- Atomization, compaction,

sintering, secondary and finishing operations. Forming and shaping of Plastics- Extrusion, Injection Molding.

Joining Processes: Physics of welding, Fusion and non-fusion welding processes, brazing and soldering, Adhesive bonding, Design considerations in welding, Weld quality defects.Machining and Machine Tool

Operations: Mechanics of machining, Single and multi-point cutting tools, Tool geometry and materials, Tool life and wear, cutting fluids, Machinability, Economics of machining, non-traditional machining processes.

Metrology and Inspection: Limits, fits and tolerances, linear and angular measurements, comparators, gauge design, interferometry, Form and finish measurement, measurement of screw threads, Alignment and testing methods.

Tool Engineering: Principles of work holding, Design of jigs and fixtures. Computer Integrated Manufacturing: Basic concepts of CAD, CAM and their integration tools.

Manufacturing Analysis: Part-print analysis, tolerance analysis in manufacturing and assembly, time and cost analysis.

Work-Study: Method study, work measurement time study, work sampling, job evaluation, merit rating.

Production Planning and Control: Forecasting models, aggregate production planning, master scheduling, materials requirements planning.

Inventory Control: Deterministic and probabilistic models, safety stock inventory control systems.

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