MECHANICAL ENGINEERING

1. Mechanics, Kinetics and Dynamics :

Statics of Particles, Equilibrium of Rigid bodies, Properties of Surfaces and Solids, Dynamics of Particles, Friction and Elements of Rigid Body Dynamics, Basics of Mechanisms, Design of CAM, Gears and Gear Trains, Friction in Machine Elements, Force Analysis, Balancing, Single Degree Free Vibration and Forced Vibration.

2. Strength of Materials and Design :

Stress, Strain and Deformation of Solids, Transverse Loading on Beams and Stresses in Beams, Torsion, Deflection of Beams, Energy Principles, Thin Cylinders and Thick Cylinders, Spherical Shells, Fundamentals of Design for Strength and Stiffness of Machine Members, Design of Shafts and Couplings, Welded Joints, Design of Springs, Design of Bearings, Design of Flywheels, Design of Transmission Systems for Flexible Elements, Spur Gears and Parallel Axis Helical Gears, Bevel Gears, Worm Gears and Crossed Helical Gears, Design of Gear Boxes, Clutches and Brakes.

3. CAD / CAM / CIM / FEA :

Fundamentals of Computer Graphics, Geometric Modeling, Visual Realism, Assembly of Parts, CAD Standards, Fundamentals of CIM, Production Planning and Control and Computerized Process Planning, Group Technology and Cellular Manufacturing, Flexible Manufacturing System and Automated Guided Vehicle System, Industrial Robotics, One Dimensional Problems in FEA, Two Dimensional Scalar Variable Problems, Two dimensional vector variable Problems, Isometric Parametric Formulation.

4. Materials Science and Metallurgy :

Constitution of alloys and phase diagrams, steels, cast iron, TTT diagram, heat treatment of ferrous and non-ferrous metal, surface modification techniques, non-metallic materials, mechanical properties and testing, crystal defects and strengthening mechanisms, conducting and semi conducting materials, magnetic and dielectric materials, Powder Metallurgy.

5. Production Technology :

Foundry Technology, Hot and Cold working, metal forming processes, metal joining processes, welding metallurgy, welding defects, Metal cutting, center lathe and special purpose lathe, drilling, milling, grinding, gear cutting, broaching unconventional machining processes, CNC machine tools, Part programming.

6. Metrology and Measurements :

Measurement uncertainty, Errors in Measurement, Linear and angular measurements, Tolerance analysis, GD&T Measurement, Surface roughness measurement, Interferometry-laser interferometers – Types, Computer Aided Inspection, Basic concept of CMM - Types of CMM, Machine vision.

7. Thermodynamics:

Basic concepts, Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. Concept of Entropy, irreversibility and availability; behaviour of ideal and real gases, thermodynamic relations, properties of pure substances, calculation of work and heat in thermodynamic processes.

8. Heat and Mass 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, NTU methods and Boiling & Condensation.

Basic Concepts of Mass transfer – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

Applications: Power Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat. I.C. Engines: air-standard Otto, Diesel cycles. Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes. Turbomachinery: Pelton-wheel, Francis and Kaplan turbines – impulse and reaction principles – velocity diagrams

9. 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 Dimensional analysis, Hydraulic turbines and Pumps etc.