

Mechanical Engineering

Syllabus

Thermal Engineering:

Thermodynamics: Thermodynamic systems and properties – Zeroth law of thermodynamics - First law of thermodynamics – Second law of thermodynamics – Steady flow energy equation - Laws of perfect gases – Characteristics gas equation – Universal gas equation. Thermodynamic processes – Entropy – Air standard cycles – Carnot cycle – Otto cycle – Diesel cycle. Properties of steam - Sensible heat - Latent heat – Degree of super heat - Dryness fraction - Simple calculations on enthalpy of steam without using steam tables and Mollier chart.

Refrigeration and Air conditioning: Fundamentals of refrigeration - Definition and meaning of refrigeration – Unit of refrigeration – COP – Carnot Refrigeration cycle and Bell column refrigeration cycle. Fuels – Types of fuels – Calorific values – Bomb calorimeter and Junker gas calorimeter.

Heat Engines : Internal Combustion Engines – Components of IC engines - Working principle – Valve and Port timing diagrams - Working of simple carburetor - Cooling system - Ignition system - Governing and Super charging of IC engines. Air compressors – Type of compressors – Single stage compressor – Multi stage Compressor - Rotary compressors. Gas turbines – Classification – Working of Constant Pressure (Open, closed and Semi closed) gas turbines - Applications and limitations of gas turbines. Steam Boilers – Classification – Working and differences between fire tube and water tube boilers - Mountings and Accessories – Performance of Boiler. Steam nozzles & Turbines – Flow through steam nozzles – Velocity and discharge through steam nozzles – Critical pressure ratio - Classification of turbines – Working principle of impulse and reaction turbines - Expression for Axial thrust, Tangential thrust, Work done and efficiencies – Methods of compounding – Governing of turbines.

Automobile Engineering:

Identify of the various components of an Automobile - Functions of basic structure, power plant, transmission system, auxiliaries, Control of the Automobile - Concept of total resistance.

Methods of manufacturing processes : Foundry - Mechanical working of metals – Powder metallurgy - Welding, soldering and brazing – Lathe and Lathe work - Drilling machines – Shaper, Slotter and Planer – Broaching Machines - Milling and Grinding machines - Modern machining processes - USM, AJM, EDM and LBM Processes - Plastics and Plastic processing - Press tools - Jigs and Fixtures.

Metrology: Linear and Angular measurements – Comparators - Measurement of surface roughness - Collimators - Interferometer.

Engineering Mechanics:

Statics: Scalar and Vector quantities - Force - System of forces – Composition and resolution of forces - Resultant of forces – Parallelogram law of forces – Moment of a force – Law of moments – Varignon's principle – Parallel forces and their resultant - Couples and moment of a

couple - Equilibrium and equilibrant – Conditions for equilibrium - Triangle and Polygon law of forces - Lami's theorem. Friction - Simple machines - Centre of gravity - Moment of Inertia.

Dynamics: Linear Motion – Motion under gravity - Newton's laws of motions – Impulse - Law of Conservation of momentum and Recoil of gun – Work, Power and Energy – Circular motion – Centripetal force – Motion of a vehicle on level circular track – Super elevation - Simple Harmonic motion – Applications of SHM.

Strength of Materials:

Simple stresses and strains – Stress and strain diagram - Hooke's law – Elastic constants - Poisson's ratio - Relationship between elastic constants – Temperature stresses - Strain energy - Shear force and bending moment diagrams – Type of beams - Types of loads - SF and BM diagrams with Point load and uniformly distributed loads for Cantilever and Simply supported beam - Theory of simple bending – Bending equation - Bending stress - Modulus of section – Deflection and slope of Cantilever and simple supported beam with Point load and uniformly distributed load - Torsion of shafts - Springs - Thin cylindrical shells.

Machine Design: Design factors - Factor of safety - Limits, tolerances and fits – Conventional symbols of Materials and machine components - modes of failure, failure theories - Welding symbols - Surface roughness values and symbols - Specifications of materials and standard components - Design of springs- Bolts, Nuts and screws - Shafts, keys and couplings - design of belt and chain drives and Gear drives – Cams - Fly wheel – Governors - Design and analysis of sliding and rolling contact bearings. Analysis of clutches and brakes.

Theory of Machines

Basic Kinematic concepts: Introduction to mechanisms, Links, Kinematic pairs, Kinematic chains, Mechanism and Inversions, Kennedy's theorem, Velocity and acceleration in mechanism, Relative velocity methods, Instantaneous center of rotation, Acceleration diagram, Acceleration center. Cams: Synthesis of translating flat-face, translating roller and oscillating roller follower cams. Gears: terminology, fundamental law of gearing, involute profile, Interference and undercutting, minimum number of teeth, contact ratio, bevel helical, spiral and worm gears, Gear Trains – simple, compound and epicyclic gear trains; sliding gear boxes and synchronous gear boxes.

Dynamics of machines: Dynamics of Rigid Bodies in Plane Motion; Dynamic Force Analysis of Machines. Balancing of inertia forces: Balancing of rotors, balancing of inline internal combustion engines. Friction Devices: Introduction to friction, Belt, chain and rope drive, Transmission of Power through friction clutch.

Engineering Materials:

Mechanical properties of engineering materials - Testing and structure of materials - Production of iron and steel – Iron/carbon equilibrium diagram - Heat treatment of steels - Ferrous and non ferrous metals and their alloys.

Hydraulics and Hydraulics Machinery:

Hydraulics: Properties of fluids - Fluid pressure and its measurement - Types of fluid flow – Reynolds's Number – Equation of Continuity – Energy of fluids - Bernoulli's theorem – Venturimeter - Pitot tube – Hydraulic Co-efficients.

Flow through pipes : Concept of loss of head in pipes due to friction - Darcy's and Chezy's formulae - Hydraulic gradient line and total energy line - Power transmission through a pipe – Syphon – Transmission efficiency - Condition for max. power transmission through a pipe.
Hydraulics Machines: Impact of jets - Water turbines : Classification of turbines - Pelton wheel - Francis turbine - Kaplan turbine – Expressions for Work, Power, and Efficiencies of Pelton wheel, Francis Turbine and Kaplan Turbine - Differences between turbines - Governing of turbines. - Hydro electric power plant and its Lay out.

Pumps: Classification of pumps - Construction and working of Reciprocating single acting/double acting pumps – Expressions for discharge, slip, Work and Power – Air vessel.
Centrifugal pumps : Construction and working of Centrifugal pumps - Expression for Work, Power, Manometric head and Efficiencies – Differences between Pumps – Priming - Foot Valve and strainer – Cavitation.

Industrial Engineering and Management:

Management: Principles and functions of management - Organization structure and organizational behavior – Production Management - Material management - Marketing and sales.

Industrial Engineering: Work study - Wages and incentives - Fundamentals of estimation – Depreciation - Elements of Costing. Linear Programming and applications, Transportation and Assignment – Game Theory - Dynamic Programming Queuing theory and its applications, forecasting approaches, Monte Carlo simulation procedure (OR). Inventory models discussion (deterministic and probabilistic Models), Newsvendor model, Inventory Planning and Control, Decision support system tools, Economic Order Quantity (EOQ).

Computer Integrated Manufacturing

Current developments in CAD- feature based modeling, design by feature, function, feature linkages, application of feature based models, parametric modeling; Computer Aided Manufacturing: fundamentals of part programming, path generation, post processing and verification; Group Technology, Computer aided process planning (CAPP), computer aided inspection and reverse engineering, manufacturing process simulation, virtual and distributed manufacturing, computer integrated manufacturing.