Mechanical Engineering

(Section 1-3: 50 Marks)
(Section -4: 50 Marks)

Section 1: Materials, Manufacturing and Industrial Engineering

Engineering Materials: Structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.
Casting, Forming and Joining Processes: Different types of castings, solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering.
Machining and Machine Tool Operations: Basic machine tools; Geometry of single and multi-point cutting tools, tool geometry and materials, principles of non-traditional machining processes; principles of work holding, jigs and fixtures;
Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement;
Additive manufacturing: Classifications and Applications
Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing.

Section 2: Applied Mechanics and Design

Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.
Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; thermal stresses;
Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; cams; gears and gear trains; dynamic analysis of linkages; flywheels ; balancing of reciprocating and rotating masses; gyroscope.
Machine 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

Section 3: Fluid Mechanics and Thermal Sciences

Fluid Mechanics: Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; Bernoulli's equation; viscous flow of incompressible fluids, elementary turbulent flow, flow through pipes, head losses in pipes, basics of compressible fluid flow, Boundary layer.
Heat Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; lumped parameter system, dimensionless parameters in free and forced convective heat transfer, heat exchanger performance, LMTD and NTU methods; view factors,
Thermodynamics: Thermodynamic systems and processes; properties of pure substances, zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics;
Applications: Power Engineering: Air and gas compressors; vapour and gas power cycles,I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; Turbomachinery: Impulse and reaction principles, steam and gas turbines.

Section 4:

Research Aptitude: Research: Meaning, Characteristics and types; Steps / Methods of Research; Research Ethics; Research and Scientific Methods; Deductive Vs Inductive Research; Defining and formulating the research problem; Important concepts related to Research design; Computing skills for scientific research

Reading Comprehension and Communication: Unseen passage based on a research article; Nature of Scientific Communication; Barriers of Communication

Reasoning: Number series; Letter series; Alphabetical codes; Structure of Arguments; Analytical Reasoning

Data Interpretation: Measures of Central Tendency, Standard Deviation & Error; Basic probability; Graphical Representation and Mapping of Data; Quantitative and Qualitative Data Analysis

Information and Communication Technology (ICT): ICT: Meaning, advantages, disadvantages and usage General abbreviations and terminologies; Basics of internet and emailing

Note: Due weightage should be given for all units of the syllabus