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| **Mechanical Engineering** | | |
| **Sr. No.** | **Core Areas** | **Percentage** |
| 1. | Mechanics of Materials | 10% |
| 2. | Engineering Drawing and Graphics | 10% |
| 3. | Mechanics of Machines | 05% |
| 4. | Machine Design | 10% |
| 5. | Manufacturing Processes | 10% |
| 6. | Fluid Mechanics | 15% |
| 7. | Thermodynamics | 15% |
| 8. | Heat and Mass Transfer | 05% |
| 9. | Engineering Mechanics (Statics & Dynamics) | 15% |
| 10. | Engineering Materials | 05% |
|  | **Total** | **100%** |

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| **Detailed** | | |
| **Sr. No.** | **Core Areas** | **Percentage** |
| **1.** | **Mechanics of Materials:**  Mechanical properties of materials, tensile, compressive and shear stress & strain, Hooke’s law, stress strain relationship, thermal stresses, torsion of circular bars, shearing force and bending moment, pure bending of beams, shear stresses in beams, beam deflection using various methods, residual stresses, analysis of statically indeterminate problems, stress concentration, thin and thick curved bars, thin walled pressure vessels. Analysis of stress and strain in two and three dimensions, principal stresses and strains, Mohr’s circle for stress and strain, thick walled cylinders, symmetrical and asymmetrical loading, introduction to fracture mechanics, impact loading, fatigue and creep, virtual work, theories of failure. Theory of columns. | **10%** |
| **2.** | **Engineering Drawing and Graphics:**  Types of lines, lettering, dimensioning, planning of drawing sheet, Types of projections, orthographic projections, plane of projections, four quadrants, projection of points, projection of straight lines, traces of a line, inclination to both the planes, projection of oblique and auxiliary planes, Loci of points and straight lines. Types of solids, polyhedra, solids of revolution, prism, pyramid, cylinder, cone, sphere. Section on plane of various solids, Geometric tolerance. | **10%** |
| **3.** | **Mechanics of Machines:**  Simple mechanism, screw threads and efficiency, friction of pivot, collar and conical bearing, cone, plate and centrifugal clutch, belts and rope drives, chains and sprockets, bands and shoe brakes, governors, effort and power, sensitivity, controlling force and stability, gyroscope, geometry of gears, gear trains, dynamometers. Linkages: synthesis and analysis, position, velocity and acceleration analysis, turning moment diagram, flywheels, cam and follower, steering gears, balancing | **05%** |
| **4.** | **Machine Design:**  Basic criteria of design of machine parts, determination of permissible and actual stresses, factor of safety, design of keys, cotters, and couplings, Design of brakes and clutches, flywheel, Design of welded, riveted and bolted joints, Design of translation screws, Design codes and standards, tolerances, standards of fits & tolerances. Kinematics, force analysis and design of spur, helical, bevel & worm gears, design of rolling contact bearings, hydrodynamic theory of lubrication, journal bearings, mechanical springs, design of belts, ropes and chains, design of shafts. | **10%** |
| **5.** | **Manufacturing Processes:**  Forming & shaping processes and equipment, material removal, cutting tools, machining processes for producing various shapes, extrusion and drawing, sheet metal forming, forming & shaping plastics & composite materials, joining process & equipment, solid state welding process, soldering , Brazing, metal casting process & equipment: powder metallurgy, surface treatment, non-conventional machining process (Laser cutting, injection molding etc.) jigs & fixtures. | **10%** |
| **6.** | **Fluid Mechanics:**  Fluid Properties, Ideal and real fluids, viscosity and compressibility of fluids, fluid pressure, absolute, gauge and vacuum pressures, difference between static and dynamic pressure, flow velocity and flow rate, Measurement of static pressure, stagnation pressure, pressure in a fluid under the action of gravity, homogeneous fluid, constant-velocity rotation of a liquid around-fixed axis, hydraulic circuits, force on container wall, force on flat surfaces, force on curved surfaces, buoyancy of fluid at rest, stability of a floating body, surface tension and capillary tubes. One dimensional inviscid flow (flow filament theory), equation of continuity, Euler’s equations of motion, Bernoulli’s equation, impulse and momentum, one dimensional viscous flow, generalized Bernoulli’s equation, flow in conduits Dimensional analysis, similitude and its applications, Buckingham- Pi theorem, Reynolds’ law of similitude, Two and three dimensional ideal fluid flow, Potential flow, circulation, stream function and velocity potential, uniform flow, two dimensional source and sink, vortex, the doublet, lift and drag forces. Two and three dimensional viscous fluid flow, Navier stokes equations of motion, two dimensional flow between parallel plates, flow in a circular pipe, creep flow, Reynold’s equation, hydrodynamic lubrication in journal bearing, Boundary layer theory, laminar & turbulent boundary layers, boundary layer control, airfoil cascades. Fluid machinery, Similarity relations for turbo machines, specific speed, classification of turbo machines, impulse turbines, reaction turbines, hydraulic jacks, pumps and their performance curves. | **15%** |
| **7.** | **Thermodynamics:**  Basic concepts and definitions, Properties of a pure substance, Equation of state, Work and Heat, First law of Thermodynamics, Internal energy and enthalpy, Second Law of Thermodynamics, Carnot Cycle, Entropy, Irreversibility and availability. Vapour power and refrigeration cycles, Air standard Power and refrigeration cycles. Thermodynamic relations, Ideal gas mixtures. Gas and vapour mixtures. Chemical reactions. Chemical equilibrium. | **15%** |
| **8.** | **Heat and Mass Transfer:**  Conduction, heat equation, Fourier’s law, one dimensional steady state heat conduction through plane and composite walls, cylinders and spheres with and without heat generating sources, critical thickness of insulation, heat transfer through extended surfaces, transient conduction, lumped capacitance method. Convection, Newton’s law of cooling, boundary layer, natural (free) and forced convection heat transfer. coefficient of heat transfer for free and forced convection, effects of laminar, transition and turbulent flow on coefficient of heat transfer, flow over flat plates, heat transfer for flow through pipes and ducts, non-dimensional parameters related to heat transfer and their applications. Shear stresses, friction coefficient for fully developed flow, Reynolds analogy, heat transfer with phase change, boiling, condensation. Radiation, Stefan Boltzmann’s law, black body radiation, absorptivity, reflectivity, transmissivity. Wien’s Displacement law, Kirchoff’s law, gray body radiation. Radiation shape factor and its applications. Mass transfer, Ficks law and its application, analogy between momentum, heat and mass transfer, Heat exchangers & classification, overall heat transfer coefficient. LMTD and NTU methods. | **05%** |
| **9.** | **Engineering Mechanics (Statics & Dynamics)**  Force System, rectangular components, moment, couples, resultant of forces, moments and couples (two and three dimensional systems). Equilibrium, Mechanical systems, isolation and equilibrium equations for two and three dimensional systems. Free body diagram, two force and three force members. Structures. Plane trusses, method of joints, method of sections, frames and machine analysis. Forces in beams and cables Friction. Types of friction, dry friction, application of friction, Kinematics of Particles, Rectilinear motion, plane curvilinear motion, rectangular coordinates, normal and tangential coordinates polar coordinates, Kinetics of Particles, Force, mass, and acceleration, Newton’s second law of motion, equations of motion, kinetic diagrams, rectilinear motion, curvilinear motion. Work and energy, potential energy. Impulse and momentum, conservation of momentum. Plane Kinematics of Rigid Bodies. Angular motion relations, absolute motion, relative velocity, instantaneous centre of zero velocity, relative acceleration. Plane Kinetics of Rigid Bodies, Force, mass, and acceleration, equation of motion, translation, fixed axis rotation, general plane motion, work and energy relationship, impulse and momentum equation. | **15%** |
| **10.** | **Engineering Materials**  Crystalline structure of metals, allotropy. Crystallographic planes, mechanisms in metals, slip and slip systems, dislocation, twinning, yield phenomenon and strain aging, Production of iron, wrought iron, cast iron. Production of steel and its classification, ferrite, austenite, S-iron, cementite, pearlite, martensite, bainite, etc. Iron-carbon phase diagram, alloying elements and their effect on the properties of alloy steel. Refining of copper, aluminum and zinc. | **05%** |
|  | **Total** | **100%** |