Civil Engg I & IInd

Civil Engineering

Paper-I

Part - A

Engineering Mechanics: Force Systems, Rigid Body equilibrium; Coplanar Concurrent forces, Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of coplanar Systems. Laws of Friction, Static and Dynamic Friction. Centroid and Centre of Gravity, Centroid of Simple figures, centroid of composite sections, Moment of inertia of plane sections, Moment of inertia of standard sections and composite sections, Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Basic Structural Analysis, Equilibrium in three dimensions, analysis of simple trusses, Simple beams and support reactions. Rectilinear motion, Plane curvilinear motion, Work-kinetic energy, power, potential energy. Impulse-momentum, Impact, Kinetics of Rigid Bodies, D'Alembert's principle and its applications in plane motion, Work energy principle, Kinetics of rigid body rotation,Virtual Work and Energy Method.

Strength of Materials : Types of stresses and strains, Hook's law, stress and strain diagram for ductile and brittle metal. Lateral strain, Poission ratio, volumetric strain, elastic moduli and relation between them, composite bar, Mohr's stress circle, three dimensional state of stress & strain, Shear force (SF) and Bending moment (BM) diagrams for simply supported, cantilevers, overhanging and fixed beams. Flexural Stresses-Theory of simple bending, bending stresses, Design of simple beam sections, Derivation of torsion equation, Combined torsion and bending of circular shafts, Shear stress distribution across various beam sections rectangular, circular, triangular, Slope and deflection – Relationship between moment, slope and deflection, Moment area method, Macaulay's method, short Columns and Struts : Buckling and stability, slenderness ratio.

Structural Analysis : Static and Kinematic Indeterminacy for beams, trusses and building frames. Analysis of determinate plane trusses. Method of substitution, method of tension coefficient for analysis of plane trusses, Castigliano's theorems, Calculations of deflections: Strain Energy method and unit load method for statically determinate beams, frames and trusses. Deflection of determinate beams by Conjugate beam method. Rolling loads and influence line diagrams for determinate beams and trusses, Types of Arches, Analysis of three hinged parabolic and circular Arches. Moving load & influence lines for three hinged parabolic arch.

Part – B

Structural Steel Design : Stress-Strain Curve for Mild Steel, Rolled Steel Sections, Limit State Design, Limit States of Strength, Limit States of Serviceability, Actions, Probabilistic Basis for Design. Riveted, Bolted and Pinned Connections, Patterns of riveted Joints, Bolted Connection, Types of Bolted Joints, Failure of Bolted Joints, Tensile Strength of Plate, Efficiency of the Joint, Combined Shear and Tension, Welded Connections, types, Weld Defects, Failure of welds, Design of eccentric welded connections. Types of Tension Members, Sectional Area, Types of Failure, Slenderness Ratio, Design of Tension Member, Lug Angles, Splices, Gusset Plate. Compression Members, Types of Buckling, Classification of Cross Sections, column formula, Built-Up columns, Lacing, Batten, Splices, Types of Beam Sections, Lateral Stability of Beams, Bending Strength of Beams, Shear Strength of Beams, Web Buckling, Built-Up Beams (plated Beams), Purlins, Effect of Holes in Beam, Plate Girder, Gantry Girder.

Design of Concrete & Masonry Structure : Design of Rectangular singly and doubly reinforced Sections by working Stress Method. Assumptions in Limit State Design method, Design of Rectangular Singly and doubly Reinforced beams, T-Beams, L-beams by Limit State Design Method. Shear Strength of beams with and without shear reinforcement, development length, Anchorage bond, flexural bond. Limit State Design method, Failure of beam under shear. Design of one way, one way continuous and cantilever solid slabs by Limit State Design Method, Design of two way slabs by limit state method, Design of columns by Limit State Design Method, Short column under axial load and uni-axial bending, Design of isolated footings, combined rectangular and trapezoidal footings by Limit State Method, Design of strap footings. Structural behavior of retaining wall, stability of retaining wall against overturning and sliding, design of cantilever retaining wall by Limit State Method.

Part - C

Bulding Materials : Stones : Requirement of good building stone, Bricks : Properties of clay bricks, Different types of bricks. Gypsum, Cement, Types of cement, Testing of cement properties, Cement Concrete, Grades of concrete, Testing of concrete, Pozzolona, Chemical composition and requirements for uses, Timber, Properties of timber, Defects in timber, Methods of seasoning and preservation of timber, Asphalt : Bitumen and Tar. Plastics, Paints, varnishes and distempers, properties and uses of aluminum and lead, Insulating Materials, Thermal and sound insulating material, Building, construction Principle and Methods for layout, Damp proofing, anti termite treatment in buildings, stair cases and their types and planning, types of floors, Bricks and stone masonry construction, Wall, Doors and Windows, roof and roof treatments, Lintel Principles of building Planning, Natural Ventilation, Water Supply and Sanitary fittings, Methods of building maintenance.

Construction Management : Quantity Estimation for Buildings, Centreline method, Long and short wall method of estimates, Types of estimates, Rate Analysis, Specification and Tenders, Different types of contracts, process of tendering, management system in construction, Bar charts, preparation of networks, PERT & CPM in construction management, Project Cost Management, Basic principle of financial planning.

Part - D

Geotechnical Engineering and Foundation Engineering : Origin and classification of Soils, Weight volume relationships, Clay minerals, Index properties, sensitivity and thixotropy, Particle size analysis, Unified and Indian standar soil classification system. Soil Hydraulics, Soil Permeability – Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil, Seepage, flow nets, critical hydraulic gradient and quick sand condition, uplift pressure, piping, Phenomena , Soil compaction, field compaction control, consolidation, Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Normal and Over Consolidated soils, Over Consolidation Ratio, Stress Distribution in soil, Boussin esq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb, contact pressure, Shear Strength : Mohr-Coulomb failure criterion, shear strength parameters, pore pressure, Soil liquefaction, Earth pressure, Coulomb and Rankine's approaches for fictional and c-φ soils, Stability of slopes – finite and infinite slopes, types of slope failure, coulomb's wedge theory, subsurface exploration. Shallow and Deep foundations, Bearing Capacity estimation, Pile foundations, Well foundations.

Civil Engineering

Paper-II

Part – A

Fluid Mechanics : Physical properties of fluids, Pressure-density height relationship, manometers, pressure on plane and curved surfaces, buoyancy, stability of immersed and floating bodies. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, path lines, streak lines, stream tube, continuity equation for 1-D, 2-D and 3-D flows, stream function and velocity potential function. Bernoulli's equation and its applications – Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation, siphon, water hammer, laminar flow through pipes, Stokes' law, velocity distribution in turbulent flow over smooth and rough surfaces, Boundary layer thickness, boundary layer over a flat plate, displacement, momentum and energy thickness. Laminar boundary layer, turbulent boundary layer, laminar sub-layer, separation and its control. Vortex flow : Free & Forced. Drag and lift, Buckingham's Pi theorem, dimensionless numbers and their significance.

Open Channel Flow : Free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels, Uniform flow: Standard equations, Equation of gradually varied flow and its limitations, Transitions of subcritical and supercritical flow, Rapidly Varied flow (RVF), Hydraulic jump, flow measurement, critical depth flumes, sluice gate, Free over fall. Rapidly varied unsteady flow, "Celerity" of the gravity wave, Flow in channel of non-linear alignment and non-prismatic channel sections, Design considerations for sub critical and super critical flows, Design of culvert. Free surface flows, Specific energy and specific force. Chezy's and Manning's equations for uniform flow in open channel. Measurments of discharge & velocity – Venturi flume.

Hydraulic Machines : Reciprocating pumps, centrifugal pumps theory and Cavitation, Rotodynamic Machines, Pelton Turbine, reaction turbines, Francis and Kaplan type, Hydraulic turbines, Hydro Power development.

Part – B

Hydrology : Hydrologic cycle, Precipitation, Evaporation, Evapotranspiration, Infiltration process, Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, hydrograph and its analysis, s-curve hydrograph, aquifers & its properties, confined and unconfined aquifers, rainwater harvesting and recharge.

Water Resources Engineering : Methods of Irrigation, Water requirement of crops, crop rotation. Canal irrigation, Parts of a canal system, Sediment Transportation, Irrigation channels and Design, silt theories: Kennedy's and Lacey's Design, Lining of Irrigation Canals, Economics of canal lining. Water Logging and Drainage Design, Regulation and control of canal system, Irrigation Outlets, river training works, Types of Head works, Failure of hydraulic structures, Principles of design, Bligh's theory, Khosla's theory for pressure and exit gradient. Design of Sarda type and straight glacis fall. Design of distributor head regulator and cross regulator, canal escape, Bed bars, Canal head works, Design of Weir, Barrage and Canal head Regulator, Cross drainage works: Necessity and types, design principles of cross drainage works, planning of dams and Reservoirs, Estimation of storage capacity, Earth Dams, Gravity dams, Spillways and their design.

Part – C

Transportation Engineering : History of road development, Geometric Design, Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves. Traffic studies on flow, speed, travel time – delay and O-D study, PCU, peak hour factor, accident study, traffic capacity, density, traffic control devices, Types of Pavements, Design of Flexible Pavement by CBR method, Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, Wet mix macadam (WMM), Granular Sub Base (GSB), Tack Coat, Prime Coat, Seal Coat, Surface Dressing, Bituminous Macadam (BM), Cement Concrete (CC) raod construction.

Railways Engineering : Permanent Way and its Components, Type of rails, rail gauges, permanent way formation, coning of wheels, defect in rails, rail fastenings, fish plates, spikes, chairs, keys, bearing plates, sleepers, sleeper density, ballast, Track Geometrics, Turnouts and Crossings, Stations and Yards, Horizontal curves and super-elevation, transition curves, points and crossings, design of turnouts, types of crossings, stations and Yards, Signalling and Interlocking, Centralized train control system, ATS, principle types of interlocking, high speed track, airport planning & design, selection of site for an airport. Airports – layout and orientation, Runway and taxiway design consideration, geometric design, Zoning laws, traffic control, Runway lighting.

Part – D

Environmental Engineering : Population forecasting by various methods, Transmission of water, Storage and distribution of water, Physical, chemical and bacteriological examination of water and wastewater: Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc. quality requirements, standards of water and waste water. Water treatment: screening, sedimentation, determination of settling velocity, efficiency of ideal sedimentation tank, design of settling tanks, grit chamber. Primary sedimentation and coagulation, filtration: theory of filtration; hydraulics of filtration; slow sand, rapid sand and pressure filters, backwashing; design of slow and rapid sand filters. Waste water treatment: unit operations, processes, Secondary and tertiary treatment, Anaerobic digestion of sludge, septic tank, up flow anaerobic sludge blanket (UASB).

Part – E

Surveying : Classification, Principles, distance, direction and elevation. Ranging. Meridians and Bearings, Methods of leveling, Booking, Reciprocal leveling, distance of visible horizon, Profile leveling and cross sectioning, Errors in leveling, plane table surveying, Contouring, Theodolite survey, Methods of horizontal and vertical control, Triangulation, Signals, Satellite station, corrections, Trigonometric leveling, simple circular curves, Transition curves – types, Vertical curves. Electronic Distance Measurement systems, Total Station – its advantages and applications, Global Positioning Systems Segments, working principle, errors, Geographic information system, Photogrammetry; basic principles, scale of a vertical photograph, relief displacement, relief displacement, flight planning, stereoscope and stereoscopy, parallax equations, Remote Sensing, Electromagnetic spectrum, atmospheric effects, image characteristics, Remote sensing systems, spectral signatures and characteristics, spectral reflectance curves, image classification, Applications of remote sensing to civil engineering.