

1. CIVIL ENGINEERING

Paper I

1. **Solid Mechanics:-** Elastic constants, plane stress, plane strain, Mohr's circle, combined stress; Elastic theories of failure; Simple bending, Shear; Torsion of circular and rectangular sections and simple members. Bending Moment and Shear Force in statically determinate beams.

2. **Structural Analysis:-** Analysis of determinate structures - different methods including graphical methods. Analysis of indeterminate skeletal frames - degree of indeterminacy, moment distribution, slope deflection, stiffness and force methods, energy methods, Muller-Breslau principle and application. Plastic analysis of indeterminate beams and simple frames - shape factors.

3. **Design of Concrete Structures:-** Limit state design for bending, shear, axial compression and combined forces. Codal provisions for slabs, beams, walls and footings. Principles of prestressed concrete design, materials, methods of prestressing, losses.

4. **Design of steel structures (Based on Limit State Method):-** Analysis and design of tension and compression members, Column bases, Connections- simple and eccentric beam-column connections.

5. **Building Material and Building Construction:-**

(a) **Building Materials:-** Cement: Components, different types, setting times, strength. Cement Mortar: Ingredients, proportions, water demand, mortars for plastering and masonry. Concrete: Importance of W/C Ratio, Strength, ingredients including admixtures, workability, testing for strength, non-destructive testing, mix design methods. Bricks: Types, Indian Standard classification, absorption, saturation factor, strength in masonry.

(b) **Building Construction:-** Types of Foundations, Brick masonry, Stone masonry, Floorings, Causes and prevention of cracks in buildings, Damp proofing, Special maintenance of buildings.

6. **Estimation, Construction Planning and Management:-** Preliminary estimate, Detailed estimate, Specifications and cost analysis. Bar chart, Linked bar chart, Work-breakdown structures, Activity-on - arrow diagrams, critical path, probabilistic activity durations, Event-based networks, PERT networks: Time-cost study, Resource allocation.

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Paper II

1. Water Resources and Hydraulic Engineering:-

(a) Irrigation Engineering:- Consumptive use of water, irrigation systems, water demand assessment; Storages and their yields, ground water and well hydraulics; Waterlogging, drainage design; Design of rigid boundary canals, lining of canals; Sediment transport in canals; Forces acting on gravity dams and their design, Design of headworks, distribution works, falls, Crossdrainage works, outlets; River training

(b) Hydrology: - Hydrological cycle, precipitation and related data analyses, Probable maximum precipitation, unit hydrograph and synthetic unit hydrographs; Evaporation and transpiration; Floods and their management, Design Flood, Streams and their gauging; Routing of floods; Capacity of Reservoirs.

(c) Fluid Mechanics:- Fluid Properties, Pressure, Thrust, Buoyancy; Flow Kinematics; Integration of flow equations; Flow measurement; Relative motion; Moment of momentum; Viscosity, Boundary layer and Control, Dimensional Analysis, Flow development, losses in pipe flows, Pipe networks, Flow measuring equipment and structures.

(d) Open Channel Flow:- Momentum and Energy principles in Open channel flow, Types of flow, Flow sections and properties; Normal flow, Gradually varied flow, Hydraulic jump.

2. Environmental Engineering:-

(a) Water Supply Engineering: - Sources of supply, design of intakes, Estimation of demand; Water quality standards; Primary and secondary treatment, detailing and maintenance of treatment units; Conveyance of treatment units; distribution systems of treated water, leakages and control; Institutional and industrial water supply.

(b) Waste Water Engineering:- Urban rain water disposal; Quantity and characteristics of waste water, Collection of waste water, Primary, Secondary and tertiary treatment of waste water, Sludge disposal, effluent discharge standards, Institutional and industrial sewage management.

(c) Solid Waste Management:- Characteristics, Generation, Collection and Transportation, Engineered systems of solid waste management (reuse, recycle, recovery, treatment and disposal). Design and Management of landfills.

(d) Air and Noise Pollution: - Air pollution: sources and impacts, air pollution controls, standards and limits. Noise pollution- impacts of noise, permissible limits, measurements and control of noise pollution.

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3. **Geotechnical Engineering:-**

(a) **Soil Mechanics:** - Fundamental definitions and interrelationships; Properties and Classification of soils, Permeability and seepage, Effective stress principles, Shear strength, Consolidation, Compaction, stress distribution in soils.

(b) **Foundation Engineering:-** Types of foundations, Foundation design requirements, Shallow foundations - bearing capacity, settlement analysis in sands and clays, Deep foundations- pile types, dynamic and static formulae, load carrying capacity of piles in sands and clays, group action, negative skinfriction, Earth pressure theories, effect of water table, layered soils, Stability of slopes, Sub-surface investigations- scope, drilling bore holes, sampling, penetration tests, plate load tests, geophysical tests.

4. **Transportation Engineering:-**

(a) **Highway Engineering:-** Geometric design of highways, Testing and specifications of paving materials, design of flexible and rigid pavements

(b) **Traffic Engineering:-** Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.

5. **Surveying:-** Principles and classification of surveys, mapping concepts, Coordinate systems, Measurement of distance and directions, Levelling, Theodolite traversing, Contours, Plane table surveying, Errors and adjustments, Curves, Total station.