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**Uttar Pradesh Public  
Service Commission  
(UPPCS Mains)  
Exam Syllabus**

**Optional Subjects**  
**Civil Engineering**

## :: PAPER - I ::

### PART-A

**(a) Theory of Structures:** Simple stress and strain, Elastic constants, Axially loaded compression members, Shear force and bending moment, Theory of simple bending, Shear stress distributions across sections, Beams of uniform strength.

Deflection of beams: Mecauly's method, Mohr's moment area method, Conjugate beam method, Unit load method, Elastic stability of columns, Castigliano's theorems I and II, unit load method of consistent deformation applied to beams and pin jointed trusses. Slope-deflection and moment distribution methods.

Rolling loads and influences lines: Influence lines for shear Force and Bending moment at a section of a beam. Criteria for maximum shear force and bending moment in beams traversed by a system of moving loads.

Influences lines for simply supported plane pin jointed trusses.

Arches: Three hinged, two hinged and fixed arches, rib shortening and temperature effects.

Matrix mehods of analysis: Force method and displacement method of analysis of indeterminate beams and rigid frames.

Plastic-analysis of beams and frames: Theory of plastic bending, Plastic analysis statical method, Mechanism method.

Unsymmetrical bending: Moment of inertia, position of Neutral axis and Principal axes, Calculation of bending stresses.

**(b) Design of Concrete structures:** Concept of mix design. Reinforced concrete: Working stress and limit state method of design. Recommendation of B.I.S. Codes. Design of one- way and two-way slabs, stair-case, slabs, simple and continuous beams of rectangular, T and L sections. Compression members under direct load with or without eccentricity.

**Cantilever and Counter-fort** type retaining walls.

**Water Tanks:** Design requirements for rectangular and circular tanks resting on ground.

**Prestressed Concrete:** Methods and systems of prestressing, anchorages, Analysis and design of sections for flexure based on working stress, loss of prestress. Earthquake Resistant Design of Buildings as per BIS codes.

### **Introduction to computer aided design of structure**

**(c) Steel Structural :** Factors of safety and load factors. Riveted, bolted and welded joints and connections. Design of tension and compression members, beams of built up section, riveted and welded plate girders, gantry girders, stancheons with battens and lacings.

## PART-B

**(a) Fluid Mechanics:** Fluid properties, types of fluids and their role in fluid motion.

**Kinematics and dynamics of fluids flow:** velocity and acceleration, stream lines, equation of continuity, irrotational and rotational flow, velocity potential and stream functions.

**Continuity, momentum, energy equations Navier Stokes equation, Euler's equation of motion Bernoulli's equation.** Applications to fluid flow problems e.g. pipe flow, sluice gates, weirs, etc.

**Laminar Flow:** Laminar and turbulent boundary layer on a flat plate, laminar sub-layer, smooth and rough boundaries, submerged flow, drag and lift forces.

**Turbulent flow through pipes:** Characteristics of turbulent flow, velocity distribution and variation of pipe friction factor, Hydraulic grade line and total energy line.

**(b) Hydraulics:** Uniform and non-uniform flows, momentum and energy correction factors, specific energy and specific force, critical depth, gradually varied flow, classification of surface profiles, control section, step method of integration of varied flow equations, rapidly varied flow, hydraulic jump. Surges.

**Hydraulic Machines and Hydropower:** Hydraulic turbines and their classification, choice of turbines, performance parameters, controls, Characteristics, specific speed, Principles of hydropower development.

**(c) Geotechnical Engineering: Soil types and structure, gradation and particle size distribution, Atterberg's limits.**

**Flow through porous media: Effective stress and pore water** Pressure, permeability concept, field and laboratory determination of permeability, Seepage pressure, quick sand condition.

Compaction of soil: Laboratory and field tests. Compressibility and consolidation theory, consolidation settlement analysis. Shear strength determination Mohr coulomb theory.

Stress distribution in soils Boussinesque and Westergaard's analysis, Earth pressure theory and analysis for retaining walls, application for sheet piles and Braced excavation.

Bearing capacity of soil: Approaches for analysis, fields tests, settlement analysis, stability of slopes.

Foundation: Type and selection criteria for foundation of structures, Design criteria for foundation, Analysis of distribution of stress for footings and pile, pile group action, pile load tests.

Subsurface exploration of soils, Ground improvement and soil stabilisation techniques.

## :: PAPER - II ::

### PART-A

#### (a) Construction Technology, Planning and Management:

**Building Materials:** Physical Properties of construction materials with respect to their use, Stones, Bricks, Tiles, Lime, Cement, Mortars, Concrete, Timber: Properties, defects and common preservation treatments, Ferro cement, fibre reinforced cement High strength concrete.

Use and selection of materials for various uses e.g. Low cost housing, mass housing, High rise buildings.

Building Constructions: Masonry Constructions using Brick, stone construction detailing and strength characteristics.

Paints, varnishes, plastics, water proofing and damp proofing materials, Detailing of walls, floors, roofs staircases doors and windows. Plastering, pointing , flooring , roofing and construction features. Common repairs in buildings.

Principle of planning of buildings for residents and specific use, Building code provisions and use.

Basic principles of detailed and Approximate estimating, specifications, rate analysis, principles of valuation of real property. Machinery for earthwork, concreting and their specific uses, Factors affecting selection of construction equipments, operating cost of equipments.

Construction activity, schedules, organizations, Quality assurance principles. Basic principle of network, CPM and PERT uses in construction monitoring, Cost optimization and resource allocation. Basic principles of Economic analysis and methods.

Project Profitability: Basic principles of financial planning, simple toll fixation criterions.

**(b) Surveying:** Common methods and instruments for distance and angle measurement for Civil Engg. works, their use in plane table, traverse survey, leveling, triangulation, contouring and topographical maps. Basic principles of photogrammetry and remote sensing. Introduction to Geographical information system.

**(c) Highway Engineering:** Principles of Highway alignments, classification and geometrical design, elements and standards for roads.

Pavement structure for flexible and rigid pavements, Design principles and methodology. Construction methods and materials for stabilized soil, WBM, Bituminous works and CC roads.

Surface and sub-surface drainage arrangements for roads, culvert structures.

Pavement distresses and strengthening by overlays.

Traffic surveys and their application in traffic planning, Typical design features for channelized, intersection rotary etc., signal designs, standard traffic signs and markings.

**(d) Railway Engineering:** Permanent way, ballast, sleeper, chair and fastenings, points crossings, different types of turn outs, cross-over, setting out of points, Maintenances of track, super elevation, creep of rails,

ruling gradients, track resistance, tractive effort, curve resistance, Station yards and station, station buildings, platform sidings turn outs, Signals and interlocking, Level Crossings.

## PART- B

### **(a) Water Resources Engineering:**

Hydrology: Hydrologic cycle, precipitation, evaporation, transpiration, infiltration, overland flow, hydrograph, flood frequency analysis, flood routing through a reservoir, channel flow routing- Muskingam method.

Ground Water flow: Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, radial flow into a well under confined and unconfined conditions. Open wells and Tubewells.

Ground and surface water resources, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation.

Water requirements of crops, consumptive use, duty and delta, irrigation methods and their efficiencies.

Canals: Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributory canals, most efficient section, lined canals and their design, regime theory, critical shear stress, bed load.

Water logging: causes and control, salinity.

Canal structures: Design of head regulators, canal falls, aqueducts, metering flumes and canal outlets.

Diversion head work: Principles and design of weirs on permeable and impermeable foundation, Khosla's theory.

Storage works: Types of dams, design, principle of gravity and earth dams, stability analysis.

Spillways: Spillway types, energy dissipation.

River training: Objectives of river training, methods of river training and bank protection.

### **(b) Environmental Engineering:**

Water Supply: predicting demand for water, impurities of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water.

Intake of Water: Water treatments: principles of coagulation, flocculation and sedimentation, slow, rapid and pressure filters, chlorination, softening, removal of tests, odour and salinity.

Sewerage Systems: Domestic and industrial wastes, storm sewage, separate and combined systems, flow through sewers, design of sewers.

Sewage Characterisation: BOD, COD, solids, dissolved oxygen, nitrogen and TOC.

Standards of disposal in normal water course and on land.

Sewage Treatment: Working principle, units, chambers, sedimentation tank, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of waste water.

Solid waste management: Collection and disposal in rural and urban contexts, management of solid waste.

Environmental pollution: Sustainable development, Radioactive wastes and disposal.

Environmental impact assessment for thermal power plants, mines, river valley projects.

Air and water pollution control acts.

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