

## ~ पाठ्यक्रम ~

राज्य सेवा परीक्षा

ऐच्छिक विषय

### 05. सिविल इंजीनियरी

इंजीनियरी विषयों के प्रश्न पत्र केवल अंग्रेजी में होंगे। अतएव पाठ्यक्रम केवल अंग्रेजी में ही मुद्रित है ।  
(परिशिष्ट एक-पैरा 4 (घ) देखें )

Syllabi for optional subjects

05 CIVIL ENGINEERING

PAPER - I

#### (A) Structural Analysis :

Principles of superposition : reciprocal Theorem unsymmetrical bending.

Determinate and indeterminate structures : simple and space frames; degrees of freedom; virtual work; energy theorem, deflection of trusses; redundant frames, three moment equation slope deflection, moment distribution and kani's methods; column analogy. Energy methods; approximate and numerical methods; Approximate methods. of analysis of rigid frames.

Moving loads- Shearing force and Bending moment diagrams in influence line for simple and continuous beams and frames;

Analysis of determinate and indeterminate arches; spandrel braced arch .

Matrix methods of analysis; stiffness and flexibility matrices. Elements of plastic analysis.

#### (B) Structural Design :

(i) **Steel Design** - Factors of safety and load factors; Design of tension, compression and flexural members; built up beams and plate girders , semi-rigid and rigid connections.

Design of stanchions, slab and gusseted bases; gentry girders; roof trusses; industrial and multi storeyed building; water tanks and towers.

Plastic design of continuous frames and portals.

**(ii) R.C.C. Design-** Working stress and limit state methods of Design of slabs, rectangular , T & L beams simply supported and continuous; column & footings isolated and combined, raft foundations over -head & under ground water tanks, encased beams and columns.

Methods and systems of prestressing; anchorages, losses in prestress; Design of prestressed beams.

### **(C) Construction , Planning and Management**

Building estimates and specifications. valuation, contract conditions and agreement, construction scheduling, CPM and PERT methods.

### **(D) Environmental Engineering**

Water quality criteria for various uses e.g. domestic & irrigational . Transmission of water. Unit processes and operations for water treatment -sedimentation, coagulation & flocculation, filtration, slow & rapid sand, decaco media filters, disinfection softening, removal of taste, odour and salinity.

Quantity and characteristic of domestic waste water sewerage system and sewage pumps, unit processes and operation for domestic waste water treatment-grit chambers primary sedimentation, biological waste treatment e.g. activated sludge trickling filters followed by secondary sedimentation, waste stabilization ponds, sludge treatment by anaerobic digestion and its disposal , waste water disposal and self purification of streams septic tanks.

Elements of air pollution, primary pollutants & their effects.

Rural sanitation, environmental pollution and ecology

**PAPER - II**

## **(A) Water Resources Engineering**

Hydrology-Hydrologic cycle; precipitation, runoff. evapotranspiration and infiltration, Hydrographs, unit hydrograph, Flood estimation, frequency analysis.

Planning for water Resources Ground and surface water resources; surface flows. Single and multipurpose projects storage capacity reservoir losses, reservoir silting, flood routing . Benefit cost ratio. planning for optimum use of water resources.

Water Requirements for crops-Quality of irrigation. water, consumptive use of water, water depth and frequency of irrigation duty of water ; irrigation methods and efficiencies.

Design of distribution system for canal irrigation Channel capacity; channel losses Alignment of main and distributory channels. Canal lining types & design Working tables for canal.

Water logging-Its causes and control , design of drainage system ; soil salinity

River training principle and Methods.

Storage works-Types of dams (including earth dams) and their characteristics, principles of design, criteria for stability, Foundation treatment, Joints and galleries Control of seepage.

Spillways-Different types, their suitability & design. Energy dissipation Spill way crest gates.

Cross drainage works. Necessity, types and their selection.

## **(B) Transportation Engineering :**

(i) Railways-Permanent way-ballast, sleeper; chairs and fastenings; points and crossing, different types of turn outs, cross-over, setting out of points.

Maintenance of track, super elevation creep of rails , ruling gradients; track resistance; tractive efforts curve resistance.

Station yards and machinery station buildings, platform and sidings turn tables.

Signals and interlocking; level crossings.

(ii) Highways and Airports-Classification of roads, planning and geometric design. Pavement materials;types, selection and testing .

Design and construction of flexible and rigid pavements of highways and airfields.

Causes of failure of pavements and road maintenance.

Traffic engineering-Traffic surveys; intersections; road signs; signals and markings.

Selection of airport sites windrose diagram and runway orientation; runway and taxiway geometries runway and taxiway lighting.

(iii) Bridge Engineering -Types and their suitability selection of site, design data collection; computation of waterways and economic span.

Loading for railway and highway bridges.

Substructure-Types, selection and construction.

### **(C) Geotechnical Engineering :**

**(i) Soil Mechanics :** Index properties and classification of soils.

Seepage : Flow through homogeneous isotropic and an isotropic earth dams.

Consolidation and settlement : Terzaghi's theory, determination of consolidation , parameters from Laboratory tests. Field compression curve. time-rate of settlement. settlement computation for under consolidated normally consolidated and over consolidated soils. Shear strength; Shear strength parameters - laboratory and field determination and their selection for the relevant field conditions. Stress path definition and typical paths for various shear tests and lateral earth pressure conditions. Skempton's pore -pressure coefficients A-B definition, determination and uses.

**(ii) Foundation Engineering** - Sub-surface exploration methods and their suitability . Methods of sampling. Soil improvement : various methods.

(a) Compaction - laboratory and field methods of compaction. Field control of moisture & density.

(b) Dewatering -methods & their selection.

(c) Soil stabilization-methods and their applicability for different types of soils including expansive type of soils.

**Shallow foundation** - Laboratory and field methods of Bearing capacity determination. Principles of footing size determination.

**Deep foundations Types & their suitability :** -

(a) Pile foundation -Types & their selection. Negative skin friction. load carrying capacity of

single piles and pile group foundation for expansive soils.

(b) Well foundation ( cussions) types selection and design principles.

Retaining walls & bulkheads- Analytical and graphical methods of earth pressure computation

Determination of depth of embedment of depth of embedment of sheet pile walls.

Stability of slopes - Types of failure surfaces, stability analysis of earth embankments for various conditions. Elements of machine foundations. Modes of vibration requirements of machine foundations.

**(iii) Rock Mechanics** -Physical properties and engineering classification of rocks, General Consideration of foundation problems in igneous, sedimentary and metamorphic rocks.