

Rajasthan Public Service Commission, Ajmer

RAJASTHAN STATE AND SUBORDINATE SERVICES COMBINED COMPETITIVE EXAMINATION

SYLLABI OF THE PAPER/SUBJECTS PRESCRIBED FOR THE MAIN EXAMINATION

OPTIONAL SUBJECT

CIVIL ENGINEERING PAPER-I (Code No. 06)

(each portion to have roughly equal weightage)

(A) APPLIED MECHANICS

Strength of Materials : Behavior of engineering materials in tension, compression and shear, elastic limit, Yield point, proof Stress, Nominal Stress and Ultimate strength, factor of safety, load factor, and elastic constants. Principal stresses and strains, strain energy. Theories of elastic failure, Analysis of structures.

Fluid Mechanics : Fluid properties, types of flow, fluid statics, forces on fully and partially submerged bodies, stability of floating bodies, Fluid kinematics, acceleration of fluid particle. Velocity potential and stream functions, irrotational flows, ideal fluid flow, Bernoulli equation, application, flow measuring devices. Momentum and angular momentum principles are applied to fluid in a control volume, applications to jets. Introduction of viscous flow, concept of drag, flow through pipes, dimensional analysis and similitude techniques.

(B) SOIL & FOUNDATION ENGINEERING

Soil exploration : Methods of site exploration, boring, sampling, standard penetration test.

Preliminary definitions and relationship : Water content and unit weight, specific gravity, void ratio porosity and degree of saturation, density index functional relationship.

Index Properties : Specific gravity, particle size distribution consistency of soils, classifications of soils.

Laboratory Test : Particle size analysis, liquid limit, plastic limit, Proctor density, field density, permeability, box shear and consolidation.

Soil Water : Inter-granular and pore water pressure, sand Boiling phenomenon, permeability.

Compressibility and consolidation : Concept of one-dimensional consolidation. Laboratory consolidation test settlement analysis.

Shear strength : Basic concept, Strength theory, Mohr's stress circle, Mohr's column failure theory, and measurement of shear strength.

Earth Pressure : Lateral earth pressure (Active & Passive), Theory Rankine's and Coulomb's theory.

Stability of slopes : Methods of slices, friction circle method, factor of safety under various conditions.

Bearing Capacity : Definition Rankine's methods. Terzaghi's analysis plate and test. Penetration test.

Compaction : Field compaction method, placement water content, field compaction control and factors affecting compaction.

(C) THEORY OF STRUCTURES

(a) Statically Determinate Structures:

Bending moment and shear force in statically terminate beams. analytical and graphical methods, stress due to bending moment and shear force, design of section, section modulus, elementary theory of torsion. Combined bending and torsion, Force in statically determinate plane trusses, analytical and graphical method.

Slope and deflection of statically determinate beams, deflection of statically, determinate plane trusses, columns, and struts. Buckling of columns. Euler's. Rankine's and secant formulae for long columns. Combined, direct and bending stresses for short columns.

(b) Statically Indeterminate Structures:

Static Kinematic indeterminacy : Energy theorems, Stiffness and flexibility method. Elementary analysis of structures, methods of consistent deformation, slope deflection and moment distribution. Analysis of beams (including continuous) and Portal frames, influence lines, influence lines for moment, shear and reaction for statically determinate beams and planner trusses. Muller-Breslau. Principles and influence lines for simple cases of indeterminate beams.

(D) STRUCTURE DESIGN

Loads : Specification for loads on buildings and bridges.

Reinforced Cement Concrete : Elastic and ultimate load theories, resistance to bending, shear and bond. Design of singly and doubly reinforced beams, one way, two way and flat slabs, columns, with axial; and moment loading, footing, cantilever and counter fort retaining walls.

Pre-stressed Concrete : Properties of high grade concrete and high tensile steel pre-tensioning and post tensioning, losses in pre-stress.

Steel Structures : Tension and compression members, single and built up section, connection and splices, roof trusses, simple beams and Purlin connections, columns, lacing and battening, Grillage, Gusseted and slab base foundation.

CIVIL ENGINEERING PAPER-II (Code No. 06)

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(A) SURVEYING

Distance Measurements : Uses of steel and metallic tapes, application of corrections, measurement of base line, errors in base line measurements, reduction to mean sea level, specifications for base line measurements, optical measurement of distances, use of substances bars, geodimeters and use of radar and laser systems in trilateration.

Angle Measurement : Principle of theodolite constructions, temporary and permanent adjustment, precision in relation to nature of work, compass, varieties, limitations, Traverse adjustments.

Vertical Measurements : Use of leveling instruments of level, level tubes, estimation of sensitivity, optics, care and maintenance parameters to define quality of telescope, leveling instruments and theodolites, methods of records and reducing, staid reductions, uses of level rods, contouring, drainage and watershed lines.

Methods of filling in details : Chain and compass, plane table and traverse surveys, Principles and adjustments of closed traverse, determination of missing data, solution of two point and three point problems, use of station pointer.

Other Surveys : Curve ranging using linear and angular measurement, simple, compounds and spiral curves, Aerial photogrammetry.

Measurement of area and volumes : use of planimeter, measurements of area and volumes including prismoidal, Trapezoidal & Simpson's method.

(B) CONSTRUCTION MATERIALS

(i) **Building Materials :** Building stones, building bricks steel (plain, Tor, High-tensile and structural), Timber line, cement, sand surkhi, cinder, stone slabs and lintels, aggregates for cement concrete, paints, distempers, use of pozzolana manufacturing of lime concrete, cement concrete for plain, reinforced and pre-stressed concrete work, additives and admixtures in concrete.

(ii) **Road materials :** Coarse aggregate, screening and binding materials for WBM. Bricks of soling, coarse and fine aggregate for bituminous roads, IRC standard size aggregates, Tars and Asphalt. Asphaltic concrete, Asphaltic emulsion, Mastic Asphalt and Minerals fillers.

(iii) **Construction :**

Stone Masonry : Ashlar, course rubble, random rubble, stone pillar, dry stone and arch masonry.

Brick Masonry : Types and their uses, hollow and reinforced brick work.

Wood Works : Doors and windows.

Steel Works : Structural steel work, metal doors and windows.

Roofing : Stone slab roofing. G.C. Steel sheet roofing, Asbestos cement sheet roofing, jack arch roofing, tile and thatch roofing.

Flooring : Cement Concrete flooring, flag stone flooring, terrazzo mosaic flooring, Terrazzo tile flooring, Brick on edge flooring, timber flooring Granolithic floor finish, linoleum & other floorings.

Plastering : Lime plaster, cement sand plaster composite plaster, rough coat plaster, Araish plastering with Gypsum, Plaster of Paris, painting.

Miscellaneous : Damp proof course, anti-termite treatment, stone cladding, sill, coping and corbelling.

Construction Management : Management of construction, plants and equipments. Planning for construction using network analysis C.P.M. and PERT techniques.

(C) HYDROLOGY AND WATER RESOURCES ENGINEERING

Hydrologic cycle, precipitation, evaporation, evapo-transpiration and infiltration, Estimation of dependable runoff factors effecting runoff. Rainfall runoff relationship, flood estimation using frequency analysis and unit hydrograph methods.

Crop water requirements. Consumptive use of water. Water depth and frequency of irrigation. Soil moisture and its variation in the root zone. Wilting point field capacity. Different methods of irrigation and irrigation efficiency. Duty delta and outlet factor.

Cropping patterns. Intensity of irrigation, Command area development and its related problems.

Diversion Head Works : Principles of design of weirs on non-permeable and permeable foundations. Khosla's theory, designs for uplift and exit gradient. Slit exclusion from canal head works.

Canals : Lined and unlined canals. Lacey's and Kennedy's theories. Tractive force approach. Types of lining and its selection criteria.

Storage Works : Different types of dams. Elementary concepts of masonry, concrete, earthen butters and arch dams. Forces gravity dams. Structural behavior stability considerations and stress variation in gravity dams Appurtenances, Foundation treatment and control of seepage.

Multi-purpose Project : Compatibility of multi purpose uses. Data needed in planning of multi-purpose water resources project. Reservoir planning, Environmental consequences of irrigation. Problems of alkalinity and salinity, Farm drainage and CAD works.

(D) TRANSPORT & TRAFFIC ENGINEERING

Survey investigation and preparation of road project. Highway standard classification, land width, building line, center line, formation width, terrain classification, pavement width. Camber longitudinal gradients, sight distance horizontal curve, super elevation, vertical curve, lateral and vertical clearances.

Design of Pavement : Flexible and rigid pavements.

Pavement construction :

- (i) Sub-base, base course and shoulder stone/kankar brick soling, WBM courses, shoulders. Granular sub-base, stabilized soil roads cement/lime stabilized sub base, sand bitumen base course, crushed cement concrete base/sub-base course.
- (ii) Bituminous Course : Prime and tack coats, surface dressing, open graded premix carpet, semi dense carpet, built-up spray grout base course, bituminous base binder course. Asphaltic concrete, seal coats, mixed seal surfacing. Penetration macadam base/binder course, full and semi grouts.

Traffic Engineering : Traffic characteristics, road user characteristics, vehicular characteristics, volume, speed and delay studies origin and destination study, traffic flow characteristics, traffic capacity and parking studies., traffic regulation, traffic control devices, intersection control.

(E) WATER SUPPLY & SANITARY ENGINEERING

Water Supply Engineering : Quantitative requirements of water supply for urban and rural areas. Variation in demand. Different sources of water supply, lakes, rivers and ground water. Intake arrangements. Drinking water standard for water. Water chemistry and water analysis. Bacteriological test. Pumping of raw water Design of rising mains. Water treatment, sedimentation, coagulation, filtration and disinfection, water softening and aeration of water. Water distribution system and their design and analysis. Boosting stations. Clear water reservoirs. Rural water supply and sanitation. Problems of low cost potable water for rural population. Tube wells for water supply. Safe yield from tube wells.

Sanitary Engineering : Sewerage, separate sewers and combined sewers. Hydraulic and structural design considerations. Different types of pipe material and different shapes of built up sewers. Superimposed load on sewers.

Characterization of Sewage : Physical, chemical and biological analysis, industrial waste water and its problem, natural purification process through soil mass and through water bodies, self purification of streams. Sewage treatment, Physical treatment, screening, skimming tanks, Grit chamber, Settling tanks. Secondary (Biological) treatment. Trickling filters and high rate bio filters. Activated sludge and accelerated aeration plants. Secondary settling tanks sludge digesters and sludge drying. Final disposal, Low cost wastewater treatment. Oxidation ponds. Oxidation ditches. Aerated lagoons. Septic and Imhoff tanks. Anaerobic lagoons. Designs consideration and general arrangement. Dry refuse disposal. Anaerobic composting and semi-aerobic composting. Urban and rural sanitation.

Environmental impact assessment & management.
