

## PUBLIC SERVICE COMMISSION, WEST BENGAL

### ASSISTANT ENGINEER (CIVIL) RECRUITMENT EXAMINATION, 2011

#### SCHEME AND SYLLABUS

The Examination shall be held in two successive stages viz.

- (I) Written Examination
- (II) Interview.

Final merit list will be prepared on the basis of total marks obtained by the candidates in the written examination and interview. The Commission shall have the discretion to fix qualifying marks in the written examination, interview as also in the aggregate.

A. The written examination will consist of one paper for all candidates.

The question paper will be of the objective type (multiple choice) comprising 100 questions. Full marks will be 200 for 100 questions of 2 marks in each.

The paper will be of 2 hours duration.

#### SYLLABUS FOR THE WRITTEN EXAMINATION

The course content of the syllabus for the paper will be of the degree level. The syllabus is given below as indicated against the respective subject module.

##### I. THEORY AND DESIGN OF STRUCTURES

(a) Theory of structures and strength of materials :-

- (i) Solid Mechanics – properties of material, Mohr's circle of stress-strain, plain stress & strain, combined stress, Elastic theories of failure, simple bending, shear, torsion of circular and rectangular sections, columns and struts, moving loads and influence lines for shear force and bending moment for-simple and continuous beams and frames.
- (ii) Structural Analysis – Analysis of determinate structures. Different methods of analysis of indeterminate structures – moment distribution, slope-deflection, column analogy, strain energy method, three moment theorem, Muller Breslau Principle and application, etc. Analysis of determinate and indeterminate arches.

(b) Steel Design – (Design of Steel Structures) :-

Principle of working stress method, Design of all types of connection, Simple members, Built up sections and frames, Design of Industrial structures and Multistoried frames, Design of steel bridges and tanks of different types, Design of tubular structures, codal provisions for design of all those steel structures including foundation.

Principle of ultimate load design; Plastic design of continuous frames and portals.

(c) Design of Reinforced Concrete and Masonry Structures :-

Limit state method of design. Codal provisions for design. Working stress method of design. Concrete mix design & Quality control, Principles of prestressed concrete design, materials, methods of prestressing, losses in prestressing, anchorages. Design of Brick masonry as per I.S. codes.

## **II. FLUID MECHANICS AND HYDRAULICS**

Fluid properties and definitions, Flow kinematics, continuity momentum and energy equations applicable to fluid flow, Bernoulli's theorem, flow through conduits, flow through open channels, Hydraulic jump, flow through pipes and losses in pipe flows, siphons, pipe network, forces in pipe ends, hydraulic energy grade line, water hammer. Viscosity, definition of ideal fluid.

## **III. SOIL MECHANICS AND FOUNDATION ENGINEERING**

- (1) Properties of soils, classifications and interrelationship; definitions of terms used; soil testing in laboratory and in-situ; compaction behaviour, methods of compaction and their choice; permeability and seepage, flow nets, flow under hydraulic structure, uplift and quicksand condition inverted filters, unconfined and direct shear stress, tri-axial test, shearing resistance, Earth pressure theories, stability of slopes; compressibility and consolidation. Theories of consolidation, pressure distribution in soils, soil stabilization, soil exploration and penetration tests, Pore water pressure.
- (2) Types of foundation, selection criteria, bearing capacity, settlement, laboratory and field tests, codal provisions in all types of foundation including testing of piles etc. Types of piles and their design and layout; Foundations on expansive soils, swelling and its prevention, Design of retaining walls, wells, sheet piles and caissons, Reinforced earth technique and its use.

## **IV. SURVEYING**

Classification of surveys, scales, accuracy; Measurement of distances-by direct and indirect methods, optical and electronic devices, Measurement of directions, Prismatic compass, local attractions; Theodolites-types, Measurement of elevations, trigonometric leveling, contours, Establishment of control by triangulations and traversing. Measurements and adjustment of observation, Computation of coordinates; Errors and their corrections of measurement of length, bearing horizontal and vertical angles and leveling operation, Correction due to refraction and curvatures, Map preparation by plane tabling and photogrammetry; Field astronomy, concept of global positioning system; Remote sensing concepts, map substitutes; Setting out directions and grades; types of curves, setting out of curves and excavation lines for building foundation.

## **V. CONSTRUCTION MATERIALS, PRACTICES, PLANNING AND MANAGEMENT**

- (1) Building Materials specifications, tests, uses and codal provisions.
- (2) Concrete technology – Cement its properties, classification and specification – Provisions in I.S. code. Properties of coarse and fine aggregates – Provisions in I.S. code, concrete mix design, Laboratory concrete, Ready mixed concrete, field tests for quality control of concrete, concreting equipments.
- (3) Earth moving machineries and pile driving equipments.
- (4) Construction planning and management – Bar chart, linked bar chart, work break down structures, Activity-on-arrow diagrams, critical path, probabilistic activity durations, Event-based network, PERT Network, Time Cost study, crashing, Resource allocation, Rescheduling of construction programme.
- (5) Quantity surveying; Methods of valuation, pricing and measurement of works; Rudiments of legal and technical aspects of engineering contracts.

## **VI. HIGHWAY ENGINEERING INCLUDING TRAFFIC ENGINEERING**

Planning of Highway systems, its classification, objects and principles, Geometric design of highway alignment, gradients, super-elevation, camber, sight distances, etc. Horizontal and Vertical curves, Transition curves, grade separations, Segregation of traffic and intersection design. Materials of highway construction its properties and tests. Sub-grade and pavement components, Types of pavements & Road drainage. Principles of highway financing, Design of pavements, evaluation of pavement failure and strengthening. Construction methods and quality control measures for highway embankment, sub-grade, pavement courses and bituminous surfacings. Elements of Design and construction of highway – Bridges and culverts including their maintenance. Principles of

transportation planning: forecasting techniques, origin and destination study; Highway capacity; Arterial routes; one-way roads and bye-pass roads; Ribbon development; Traffic control devices; Traffic study and parking surveys, speed, volume and delay studies; Accident characteristics; Traffic signal; Traffic projection factor.

## **VII. WATER RESOURCES ENGINEERING**

- (1) Hydrology – Hydrologic cycle, Measurements, Computations and statistics; Run off and stream flow, Measuring techniques and computations; Hydrographs, Computations and interpretation; ground water, Estimation, Measurements, Characteristics.
- (2) Irrigation Engineering – Types of irrigation systems and their detail description, soil-water-crop relationship; Types of soils; water requirement of crops; Delta and duty. Classification of rivers; River Regime Theory; Effects of dams on river regime; River training works. Irrigation channels; Design principles of irrigation canals, Drainage channels and Navigation canals; canal linings; canal outlets. Water logging and salt efflorescence, land reclamation.
- (3) Hydraulic structures – Storage Reservoirs; Different types of dams and their design principles; Weirs, barrages and their design principles; spillways, Energy dissipation by hydraulic jump; different types of energy dissipation. Headworks; cross drainage works; Falls and Regulators.

## **VIII. ENVIRONMENTAL ENGINEERING**

- (1) Water Supply Engineering :-  
Water uses, Quantity requirements, potable water quality, sources of water, ground water hydraulics, Development of surface source; Reservoir volume, Transmission of water. Treatment of water; Typical flow-sheets for surface and ground sources; sedimentation, coagulation and flocculation, filtration, disinfection, hardness and chemical softening; Rudiments of Ion-exchange; Elements of rural water supply and removal of Iron, Arsenic and salinity from water. Principles and methods of design of distribution systems, service reservoirs, and Intakes for urban and rural water supply.
- (2) Waster Water Engineering :-  
Sanitary Waster Water and Stormwater run off : Quantity estimation, Sewerage systems and their design principles; Sewer construction materials; structural design of sewers; Sewer appurtenances; Characteristics of domestic sewage; Typical flow-sheets for primary and secondary treatment; Design principles of screen, grit-removal, sedimentation, Bio-filter, Activated sludge process and Septic tank, Elements of industrial sewage and its treatment; Rural Sanitation its principles and practices.
- (3) Environmental pollution and control :-  
Atmospheric pollution : Types of pollutants, Natural and man-made sources, Effects of air pollution, unit systems; Rudiments of control methods; Elements of noise pollution. Community solid wastes; Sources, Quantity and characteristics, Methods of disposal, Reuse and cycling. Water quality management; Quality criteria for major uses of water; Applied stream sanitation.

## **B. Interview**

The full marks for interview will be 100.