

# SYLLABUS OF WRITTEN EXAM

## MAHARANA PRATAP UNIVERSITY OF AGRICULTURE AND TECHNOLOGY UDAIPUR

### Assistant Engineer (Civil) – Recruitment Exam – 2023

#### Examination Scheme

Question Paper	No. of questions	Marks	Max. Marks	Time
Part-I : General Knowledge	30	90	450	3 hrs
Part-II : Civil Engineering	120	360		

#### Note:

- There will be a total of 150 questions for 450 marks.
- The total duration for the examination is 3 hours
- The marking scheme is 3 marks for every correct answer and will have a negative marking of 01 marks for each wrong answer.
- Minimum 40% marks should be obtained to qualify the examination. The candidate obtaining below 40% marks will not be eligible for appointment.

**General Knowledge and General Science including General Knowledge of Rajasthan – Its Geography, Economy and culture:**

**1. Current affairs:** - Current events of State, National and International importance. National & International agencies and their activities. Games & Sports at State, National and International levels.

**2. History & Culture:** - Land Marks in the political and cultural history of India. Major monuments and literary works. Renaissance, struggle for freedom and national integration. History & Culture of Rajasthan with special reference to:- (a) The medieval background. (b) Socio-economic life and organisation. (c) Freedom movement and political awakening. (d) Political integration. (e) Dialects and Literature. (f) Music, Dance & theatre. (g) Religious beliefs, cults, saints, poets, Warrior-saints, Lok Devtas & Lok Devyan. (h) Handicrafts. (i) Fairs and Festivals, Customs, Dresses, Ornaments with special reference to Folk & tribal aspects thereof.

**3. General Science:** - General Science will cover General appreciation and understanding of Science including matters of everyday observations and experiences. Candidates are supposed to be familiar with matters such as electronics tele-communications, Satellites and elements of computers (both Hard & Soft Wares), research labs including CSIR managed national labs and institutes. Environment & pollution etc.

**4. Economic Developments with special reference to Rajasthan:** - Food and Commercial Crops of Rajasthan, Agriculture based Industries, Major irrigation and River Valley Projects, Projects for the development of the desert and waste lands. Indira Gandhi Canal Project, growth and location of industries, Industrial raw materials. Mineral based industries, Small scale and Cottage industries, export items Rajasthani handicrafts, Tribes and their economy. Cooperative movement. Tourism Development in Rajasthan. Various five years Plans: Objectives and

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progress. Major economic problems of Rajasthan and obstacles for economic development. Current budget of Rajasthan and Central Government. Economic Reforms in India and their impact. Commercial banks and other financial institutions in Rajasthan.

**5. Geography and Natural Resources:-** (I) Broad – physical features of the world important places, rivers, mountains, continents, oceans. (II) Ecology and wild – life of India. (III) Rajasthan's Physiography: Climate, vegetation and soil regions. Broad physical divisions of Rajasthan. Human resources: problems of population, unemployment, poverty, Drought, famine and desertification in Rajasthan. Natural resources of Rajasthan. Mines and Minerals, forests, Land water. Animals' resources. Wild-life and conservation. Energy problems and conventional and non-conventional sources of Energy.

## **CIVIL ENGINEERING**

**A. STRENGTH OF MATERIALS:** Behaviour of engineering materials in tension, compression and shear, elastic limit, yield stress, proof stress, nominal stress, actual stress and ultimate stress, factor of safety, load factor and elastic constants. Principal stresses and strains, Strain energy, theories of elastic failure. Bending moment and shear force in statically determinate beams, stress due to bending moment and shear force, design of section, section modulus, elementary theory of torsion, combined bending and torsion. Forces in statically determinate plane trusses. Slope and deflection of statically determinate beams, deflection of statically determinate frames – Buckling of columns. Euler's, Rankine's and secant formulae. Combined, direct and bending stresses for short columns. Thin cylindrical and spherical shells.

**B. SOIL AND FOUNDATION ENGINEERING:** Soil Exploration: Methods of site exploration, boring, sampling, standard penetration test. Preliminary definitions and relationship: Water content unit weight, specific gravity, void ratio, porosity and degree of saturation, density index, phase relationship. Index Properties: Specific gravity, particle size distribution, consistency of soils. Classifications of soils, field identification. Laboratory Test: Particle size analysis, liquid limit, plastic limit, proctor density, field density, permeability, shear box and unconfined. Soil water: Inter-granular and pore water pressure, Quick sand phenomenon, permeability, Flow not and its uses. Vertical pressure distribution: Boussinesq's equations, Circular load, pressure bulb and its significance, Newmark's chart. Contact pressure distribution. Consolidation: Concept of one-dimensional consolidation. Laboratory consolidation test, over-consolidated normally consolidated soils, settlement analysis. Shear Strength: Basic concept, Mohr-Coulomb Failure theory and measurement of shear strength. Earth Pressure: Lateral earth pressures (Active and Passive), Rankine's and Coulomb's theory. Stability of slopes: Methods of slices, friction circle method, Taylor's method. Bearing Capacity: Definitions, Terzaghi's method, general shear and local shear failures, plate load test. Compaction: Field Compaction method, water content, field compaction control and factors affecting compaction. Pile Foundation: Types of piles, driving of piles, load carrying capacity of piles, pile load testing, under-reamed pile foundation, bored compaction piles. Well Foundations: Caissons, shapes of wells and component parts depth of well foundation and bearing capacity, forces acting on a well foundation. Well sinking.

**C. THEORY OF STRUCTURES:** Statically Indeterminate Structures : Static and kinematics indeterminacy, Energy theorems, Stiffness and flexibility methods elementary analysis of

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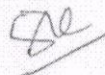
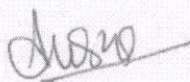
structures, methods of consistent deformation, slope deflection and moment distribution. Analysis of beams (including continuous) and portal frames, Influence lines, Influence lines for moment, shear and reaction for statically determinate beams and planar trusses. Muller-Breslau Principle and influence lines for indeterminate beams. Rolling loads on beams- shear force and bending moment due to concentrated loads, uniformly distributed loads- shorter and longer than span.

**D. STRUCTURAL DESIGN-I:** Loads: Specifications for loads on buildings and bridges. Reinforce cement concrete: Limit state theory, resistance to bending, shear and bond. Design of singly and doubly reinforced beams, one way, two way and flat slabs, columns with axial and uniaxial moment loading, footing, cantilever and counterfort retaining walls, simple underground and elevated reservoirs, cantilever sheds, simple rectangular portal frames, spherical domes, staircase. Pre-stressed Concrete: Properties of high grade concrete and high tensile steel, pre-tensioning and post tensioning losses in pre-stress. Analysis and design of rectangular beams and slab.

**E. STRUCTURAL DESIGN-II:** Steel Structures : Tension and compression members, single and built up sections, connection and splices, roof trusses, simple beams and Purlin connections, columns, lacing and batten, Grillage, Gusseted and slab base foundation. Plate and gantry girders, through and deck type plate girder bridges and with lateral bracings.

**F. 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 function, irrotational flows, ideal fluid flow, Bernoulli's, Navier Stokes, Reynold's equations, application. Flow measuring devices. Momentum and angular momentum principles as applied to fluid in a control volume, applications to jets. Introduction of viscous flow, concept of drag. Flow through pipes, Laminar and turbulent. Equations for boundary layer thickness and boundary shear over flat plates. Channel Flows (GVF and RVF), surges. Dimensional analysis and similitude techniques.

**G. SURVEYING:** Distance Measurements: Use 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 measurements of distances, use of substance bars. Angle Measurements: Principles 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, stadia reductions, use 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. Other Surveys: Curve ranging using linear and angular measurements, simple compound and spiral curves. Measurements of area and volumes: Use of planimeter, measurements of areas and volumes including prismoidal, trapezoidal and Simpson's method.





**H. CONSTRUCTION MATERIALS:** (i) Building Materials : building stones, building bricks, steel (Plain, Tor, High-tensile and Structural), Timber, lime, 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. (ii) Road Materials: Coarse aggregate, screenings and binding materials for WBM. Bricks for soling. coarse and fine aggregate for bituminous roads, IRC standard size aggregates, Tars and Asphalt. Asphaltic concrete, Asphaltic emulsions, Mastic Asphalt and Minerals fillers. (iii) Constructions Stone Masonry: Ashlar, course rubble, random rubble, stone pillar, dry stone and arch masonry. Bricks Masonry: Types and their uses hollow and reinforced brick work. Wood work: 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 file flooring, Brick on edge flooring, timber Granolithic floor finish, linoleum and 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, sill, coping and corbelling. Centering and Shuttering: Centering form work, shuttering and moulds, timber trestles and false work, scaffolding and shoring, under pinning. Sanitary and Water Supply : Providing and laying galvanized iron PVC, asbestos cement, stone ware, cast iron and RCC pipes; sewerage and drainage system; over head and under ground tanks; manholes and gully chambers ; septic tank; soak pit, dispersion trench, floor and wall treatment in toilets, glazed tile work, downpour pipes. Construction Management: Management of construction, plants and equipments. Planning for construction using network analysis C.P.M. and PERT techniques. Shallow foundation: spread foundation, combined footing and strap footing, Mat or Raft Footing.

**I. HYDROLOGY AND WATER RESOURCES ENGINEERING:** Engineering Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration and infiltration. Estimation of dependable runoff factors effecting runoff. Rainfall runoff relationship, flood/drought estimation using frequency analysis and unit hydrograph methods. Groundwater hydrology, aquifers, steady flow towards fully penetrating wells confined and unconfined aquifers. 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. Silt 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. Lift Irrigation from Canals and Wells Ground water availability in unconfined aquifers. Safe yield formulae, construction and maintenance of wells. Relative merits of lift irrigation and flow irrigation. Storage Works: Different types of dams. Elementary concepts of masonry, concrete, earthen, butteress and arch dams. Forces gravity dams. Structural behaviour 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 multipurpose water resources projects. Reservoir planning, Environmental

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consequences of irrigation. Water logging, problems of alkalinity and salinity, Farm drainage and CAD works.

**J. TRANSPORT AND 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 pavements. Pavement Construction: 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. 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. System approach in traffic management. Bridge Engineering: Components of bridges, classification of bridges, requirements of an ideal bridge, selection of bridge site, Bridge alignment, site investigation and collection of data, waterway of bridges. Economic span scour depth of foundation, Afflux, clearance, free board. Type of bridge superstructures and methods of erection, bridge bearings, joints in bridge, wearing coat, Railing, parapet and approach slab. Type of bridge foundation, bridge pier, adjustment and wing walls. Training work for bridges and protection works. Low cost bridges, causeway, timber bridges, suspension bridges, pipe and slab culverts.

**K. WATER SUPPLY AND SANITARY ENGINEERING:** Water Supply Engineering: Quantitative requirements of water supply for urban and rural areas. Variation in demand. Forecast of population. Different sources of water supply, lakes, rivers and ground water. Intake arrangements. Drinking water standard for water. Bacteriological test. Pumping of raw water. Design of rising mains. Water treatment, flow diagram, sedimentation coagulation, filtration and disinfection, water softening and aeration of water. Water distribution system and their design and analysis. 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 build up sewers. Superimposed load on sewers. House plumbing, various accessories and arrangement. Sewage pumping station. Characterization of Sewage : Physical, chemical and biological analysis, Industrial waste water and its problems, 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 waste water treatment oxidation ponds, oxidation ditches, aerated lagoons, septic tank, anaerobic lagoons. Dry refuse disposal. Basic concepts of Urban and Rural sanitation.

