# नेपाल विद्युत प्राधिकरण
## प्राविधिक सेवा, सवै समूह/उपसमूह, तह ७ ईन्जिनियर पदको लागि आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पाठ्यक्रम योजनालाई निम्नानुसार दुई चरणमा विभाजन गरिएको छः

प्रथम चरणः- लिखित परीक्षा **पूर्णाङ्कः- २००**

द्वितीय चरणः- अन्तर्वार्ता **पूर्णाङ्कः- ३०**

परीक्षा योजना (Examination Scheme)

**प्रथम चरणः लिखित परीक्षा** **पूर्णाङ्कः- २००**

| पत्र | विषय | पूर्णाङ्क | उतीर्णाङ्क | खण्ड | परीक्षा प्रणाली | | प्रश्नसंख्या * अङ्कभार | समय |
|---|---|---|---|---|---|---|---|---|
| प्रथम | व्यवस्थापकीय ज्ञान | १०० | ४० | क | विषयगत | छोटो उत्तर आउने प्रश्न | २ प्रश्न * ५ अंक | ३ घण्टा |
| | | | | | | लामो उत्तर आउने प्रश्न | ४ प्रश्न * १० अंक | |
| | | | | ख | | छोटो उत्तर आउने प्रश्न | २ प्रश्न * ५ अंक | |
| | | | | | | लामो उत्तर आउने प्रश्न | ४ प्रश्न * १० अंक | |
| द्वितीय | सेवा सम्वन्धी (विस्तृत ज्ञान) | १०० | ४० | क | विषयगत | छोटो उत्तर आउने प्रश्न | २ प्रश्न * ५ अंक | ३ घण्टा |
| | | | | | | लामो उत्तर आउने प्रश्न | ४ प्रश्न * १० अंक | |
| | | | | ख | | छोटो उत्तर आउने प्रश्न | २ प्रश्न * ५ अंक | |
| | | | | | | लामो उत्तर आउने प्रश्न | ४ प्रश्न * १० अंक | |

**द्वितीय चरणः- अन्तर्वार्ता** पूर्णाङ्कः- ३०

| विषय | पूर्णाङ्क | परीक्षा प्रणाली |
|---|---|---|
| अन्तर्वार्ता | ३० | मौखिक |

**द्रष्टव्यः**

१. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ।

२. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टा छुट्टै हुनेछ।

३. लिखित परीक्षामा सोधिने प्रश्नसंख्या र अंकभार यथासम्भव सम्वन्धित पत्र/विषयमा दिईए अनुसार हुनेछ।

४. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरुको गलत उत्तर दिएमा प्रत्येक गलत उत्तरवापत २० प्रतिशत अंक कट्टा गरिनेछ। तर उत्तर नदिएमा त्यसवापत अंक दिईने छैन र अंक कट्टा पनि गरिने छैन।

५. वस्तुगत बहुवैकल्पिक हुने परीक्षामा परीक्षार्थीले उत्तर लेख्दा अंग्रेजी ठुलो अक्षर (Capital Leter) A,B,C,D मा लेख्नु पर्नेछ। सानो अक्षर (Small Leter) a,b,c,d लेखेमा वा अन्य कुनै संकेत गरेको भए सवै उत्तरपुस्तिका रद्द हुनेछ।

६. बहुवैकल्पिक प्रश्नहरु हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाईने छैन।

७. विषयगत प्रश्नहरुको हकमा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा वढी भाग (Two or more Parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा वढी टिप्पणीहरु (Short notes) सोध्न सकिनेछ।

८. विषयगत प्रश्न हुने पत्र/विषयमा प्रत्येक खण्डका प्रश्नका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरु हुनेछन। परीक्षार्थीले प्रत्येक खण्डका प्रश्नको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नु पर्नेछ।

९. यस पाठयक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जुन सुकै कुरा लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम, विनियम तथा नीतिहरु परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्नेछ।

१०. प्रथम चरणको परीक्षावाट छनौट भएका उम्मेदवारलाई मात्र दोश्रो चरणको परीक्षामा सम्मिलित गराईनेछ।

११. **पाठयक्रम स्वीकृत मितिः- २०८०/०८/२१**

**नेपाल विद्युत प्राधिकरण**

**प्राविधिक सेवा, सवै समूह/उपसमूह, तह ७ ईन्जिनियर पदको लागि आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम**

**<u>प्रथमपत्र :</u> व्यवस्थापकीय ज्ञान**

**खण्ड (क) - ५० अङ्क**

## १. विद्युत विकास र संस्थागत जानकारी

१.१ नेपालको जलस्रोत विकासमा नेपाल विद्युत प्राधिकरणको भूमिका
१.२ नेपालको उर्जा विकासमा नेपाल विद्युत प्राधिकरण र निजी क्षेत्रको भूमिका
१.३ नेपालको आर्थिक, सामाजिक विकासमा नेपाल विद्युत प्राधिकरणको भूमिका
१.४ नेपालमा सार्वजनिक संस्थान स्थापनाको उद्देश्य तथा यसका भूमिका एवम चुनौतीहरु
१.५ संघीय अवधारणा अनुसार नेपाल विद्युत प्राधिकरणको पुन:संरचना
१.६ आवधिक योजनामा उर्जा विकास सम्वन्धी व्यवस्था
१.७ दिगो विकास र वातावरण
१.८ विद्युतका नियामक निकायहरुको जानकारी
  १.८.१ उर्जा, जलस्रोत तथा सिंचाई मन्त्रालय
  १.८.२ जल तथा उर्जा आयोग
  १.८.३ विद्युत नियमन आयोग
  १.८.४ विद्युत विकास विभाग
१.९ उर्जाका स्रोतहरु
१.१० नेपालमा उर्जा विकासको अवस्था, सम्भावना, समस्या, अवसर र चुनौतीहरू
१.११ सामूहिक सौदावाजी र ट्रेड युनियनको काम, कर्तव्य तथा अधिकार
१.१२ आयोजना व्यवस्थापन र यसका चुनौतिहरु
१.१३ Energy Effeciency and Demand side Management
१.१४ Energy Exchange, Energy Trading, Energy Banking, Energy Pool Market, Regional Grid

## २. संविधान, ऐन, नियम तथा विनियमहरु

२.१ नेपालको संविधान
२.२ नेपाल विद्युत प्राधिकरण ऐन, २०४१
२.३ विद्युत ऐन, २०४९
२.४ विद्युत चोरी नियन्त्रण ऐन, २०५८
२.५ विद्युत नियमन आयोग ऐन, २०७४
२.६ जलस्रोत ऐन, २०४९
२.७ वातावरण संरक्षण ऐन, २०७६
२.८ जग्गा प्राप्ती ऐन, २०३४
२.९ सार्वजनिक खरिद ऐन, २०६३
२.१० सार्वजनिक खरिद नियमावली, २०६४
२.११ वातावरण संरक्षण नियमावली, २०७७
२.१२ विद्युत चोरी नियन्त्रण नियमावली, २०५९
२.१३ नेपाल विद्युत प्राधिकरण, प्रचलित कर्मचारी सेवा शर्त विनियमावली,
२.१४ नेपाल विद्युत प्राधिकरण, प्रचलित आर्थिक प्रशासन विनियमावली,
२.१५ सामुदायिक ग्रामिण विद्युतीकरण विनियमावली, २०७१

## नेपाल विद्युत प्राधिकरण

## प्राविधिक सेवा, सवै समूह/उपसमूह, तह ७ ईन्जिनियर पदको लागि आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

२.१६ विद्युत वितरण विनियमावली, २०७८

२.१७ विद्युत महशुल संकलन विनियमाली,२०७९

### खण्ड (ख) - ५० अङ्क

1. **Hydropower Development :** Historical Background of Power Development; Geographical, Geological, and Topographical opportunities and challenges of hydropower development in Nepal; Types of hydropower plants (based on head, capacity and layout), Criterion used for Estimation of power and energy potential; Stages of hydropower developments - Reconnaissance, Master Plan, Pre-feasibility, Feasibility and Detail design; Economic and financial analysis and project selection; Tendering, contracting and contract management; Co-ordination of civil, hydro-mechanical, electro-mechanical and electrical works during project construction; Operation and maintenance planning and implementation

2. **Developmental and Operational Issues in Hydropower :** Project Cycle; Hydropower Planning – site selection, capacity optimization; Types and components of hydropower projects and their selection – ROR, PROR, Storage and Pump Storage projects; Sediment Handling in Hydropower Projects; Project type mix and its importance; Selection criteria of turbines and generators; Multipurpose storage hydropower projects and inter-basin transfer; Cascade river development and impacts on upstream and downstream projects; Environmental and social issues of hydropower development; Public involvement and participation in hydropower projects; Social services and community development

3. **Electro-Mechanical and Hydro-Mechanical Equipments and Power Plant Operation** Duties and responsibilities of the operator in charge; Data sharing and communication with LDC in plant operation; Concept of SCADA system; Inspection requirement and protocol; Preventive, corrective, routine, and scheduled maintenance; Occupational health and safety in operation and maintenance at the power house; Fire hazard and fire fighting in power house and switch yard; Issues and challenges of transporting heavy equipment to the site

4. **Transmission and Distribution :** Structural design and alignment fixing criterion of transmission and distribution line; Selection of voltage level and clearance requirement of conductors of transmission and distribution lines; Environmental and social issues during routing, construction and operation; Integrated Nepal Power System; Challenges and opportunities of cross-border and regional grid inter-connections; Occupational health and safety in operation and maintenance of transmission lines, substations, and distribution systems; Fire hazard and fire fighting in substations; Safety tools and equipment, Safety Protocol, Types of Transmissions Towers and uses in Nepalese context

5. **Power System in Nepal :** Load growth and forecasting; Estimation of peak load and peak demand, Concept and importance of energy mix and generation mix; Transmission and distribution master plan; Technical and non-technical losses in transmission and distribution systems; Loss reduction measures; Concept of smart meter and smart grid; PPA, PDA, PPA-Guidelines; Electricity; Energy audit and energy market

6. **Quality control :** Types of Test of Materials, Machines and Equipment, Testing Lab and its Accrediation and Calibration of Testing equipments

नेपाल विद्युत प्राधिकरण

प्राविधिक सेवा, सिभिल समूह/उपसमूह, तह ७, ईन्जिनियर पदको लागि आन्तरिक

प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

## द्वितीयपत्र

## सेवा सम्वन्धी विस्तृत ज्ञान

## खण्ड (क) - ५० अङ्क

1. **Fluid Mechanics and Hydraulics**
   - 1.1. Physical Properties of Fluid: Mass density, specific gravity, specific weight, Viscosity, Surface tension and capillarity
   - 1.2. Hydro-statics: Pressure, Pascal's Law, Hydrostatic Law, Measurement of Pressure, Pressure force on vertical, horizontal, inclined and curve surfaces and its points of application, centre of pressure, Archimedes's, Principle, Buoyancy and flotation, Stability of floating and submerged bodies
   - 1.3. Hydro-dynamics: Energy of flowing fluid, Principle of conservation of Energy and momentum, Euler's equation along streamline, Bernoulli's equation and it's applicability
   - 1.4. Hydro-kinematics: Different types of fluid flow: Laminar and turbulent flows, Steady and unsteady flows, Uniform and non-uniform flows, Compressive and incompressible flows, Ideal and real flows, pressure flows and pressure-less flows. Flow measurement: Discharge through a sharp-edged orifice, Discharge over rectangular, triangular and trapezoidal weirs and notches, Venturimeter and its application
   - 1.5. Pipe flow and open channel flow: Flow characteristics, losses in pipe flows, Open channel flow analysis: Chezy's formula, Manning's formula, Froude's number and hydraulic jump

2. **Soil Mechanics**
   - 2.1 Index properties of soil: Mechanical analysis, Sieve analysis, Particle size distribution, Soil consistency limits and Plasticity index
   - 2.2 Soil phases and phase relationships Three phase system of soil, Solid, water and air relationship in a soil: volume relationships, weight relationships
   - 2.3 Darcy's law and flow through porous media Soil water relation: Water table, Permeability, Darcy's law
   - 2.4 Compaction and consolidation: Major differences and methods, factors affecting, measurement of primary and secondary consolidation. Compaction equipment and field compaction methods
   - 2.5 Shear strength and bearing capacity of soil: Mohr-Coulomb failure criterion Factors affecting, Mohr's circle, unconfined compression test

3. **Engineering Mechanics, Strength of Materials and Mechanics of Structures**
   - 3.1 Equilibrium: Lami's theorem, Moment and Varignon's theorem, condition of equilibrium of rigid bodies under the action of coplanar forces
   - 3.2 Simple stress and strain: Hook's law, Young's modulus of elasticity, Bilk modulus, Modulus of rigidity, Thermal stress, Poisison's ratio
   - 3.3 Centroid Centre of gravity of various bodies (shapes), Moment of inertia of various bodies, Transformation theorem, Polar moment of inertia
   - 3.4 Friction and it's coefficient, friction on horizontal and inclined plane
   - 3.5 Shear force and bending moments determinant structures under various types of loadings
   - 3.6 Theory of Simple bending: Assumptions, Moment of resistance, Section modulus

4. **Structural Analysis and Design**
   - 4.1 Reinforced concrete structures: Analysis and design of Singly and doubly reinforced rectangular sections: slab and beams, columns; shear and bond stress and design
   - 4.2 Timber structures: Design of compression and tension members
   - 4.3 Steel structures: Design of compression and tension members, Design of roof trusses; Design of joints in members: Riveted, bolted and welded
   - 4.4 Knowledge to use of various Code of Practice in Nepal in Design: RCC / Steel / Timber structures

5. **Basic Drawing Techniques**
   - 5.1 Purpose and importance of drawing as language of engineering
   - 5.2 Fundamentals of Standard drawing sheets Concept of drawing sheet composition and its essential components
   - 5.3 General knowledge of drawing tools and equipment
   - 5.4 Concept of drafting conventions and symbols
   - 5.5 Scales using for site plans; Introduction to preliminary drawings, working drawings, etc.
   - 5.6 Theory of projection drawing; perspective view, orthographic projection; first and third angle projection, pictorial view Sectional and Isometric views
   - 5.7 Introduction to Civil Engineering drawings: Site plan, preliminary drawings, working drawings, topographic, electrical, mechanical, plumbing and structural drawings
   - 5.8 Concept and techniques of free hand drawing

6. **Surveying**
   - 6.1 Introduction and basic principles of surveying General concept and classification of surveying and its basic principles
   - 6.2 Linear measurement techniques, representation of measurement and common scales, Methods of Chain / Compass / Plane table / Theodolite / Total Station survey: traverse survey, field and table works
     - 6.2.1 Linear measurements and its techniques, Introduction to : chain, tape, ranging rods and arrows; and their uses; measurement and scales; sources of errors; effect of slope and slope correction Abney level and clinometers.
     - 6.2.2 Compass and plane table survey: types of compass; problems and sources of errors of compass survey; bearings; principles and methods of plane table survey
   - 6.3 Leveling and Contouring General knowledge on leveling and contouring: principles of leveling; temporary and permanent adjustment of level; bench marks; booking methods and their reductions; longitudinal and cross sections survey; reciprocal leveling; trigonometric leveling; contour interval and their characteristics; method of contouring
   - 6.4 Stadia and Tacheometry: Principles, different system of measurements, uses of stadia methods: indirect leveling
   - 6.5 Trigonometric leveling: Base of both accessible and inaccessible objects
   - 6.6 Introduction to Theodolite traversing: Need of traverse and its significance; computation of coordinates; adjustment of closed traverse and closing errors
   - 6.7 Elements, methods, and design of simple, vertical and transition curves

6.8 Introduction and use of Total station equipments and Electronic Distance Measuring Instruments and its importance

## खण्ड (ख) - ५० अङ्क

7. **Construction Materials**

7.1 Properties of civil engineering materials: Physical, Chemical and thermal etc General knowledge of various construction materials, their properties, tests and their use in construction
Bricks: types and testing of bricks and brick masonry; Stone:characteristics and requirements of stones as a construction material and stone masonry; Cement and cement mortar; Timber and : timber products

7.2 Natural and artificial building materials and their characteristics and use in construction: Sand, stones, boulders, bricks, concrete blocks

7.3 Cementing materials: types and properties of lime and cement; cement mortar tests. Concept of cementing materials: types, composition and properties of cementing materials: Lime and cement

7.4 Construction materials: steel and alloys, their types and properties

7.5 Construction materials: wood and timber; their types and properties; Different trees available in the country

7.6 Cement concrete: Concrete mix design, concrete tests: cube test, slump test. Water - cement ration and its role in concrete strength and workability.

7.7 Reinforced cement concrete: Bar bending schedule, form work, development lengths, and clear covers and cover strips, casting and curing

7.8 Ceramic materials: ceramic tiles, Mosaic tiles

8. **Construction Management**

8.1 Planning of construction site, scheduling of construction items, monitoring of construction works and quality control methods and technology

8.2 Project scheduling (bar chart, CPM, PERT) Network techniques: Bar chart, CPM and PERT; modern tools of construction management, Construction Management in Developing Countries

8.3 Contract: Essentials, types, conditions, documents, and management

8.4 Duties and responsibilities of Client, Consultant, and Contractor

8.5 Quality control and maintenance management, Nano Technology in QC

8.6 Safety engineering: Safety measurement of labor, safety wearing, safety tools

8.7 Accident and its cause and primary treatment. Workers insurance and its policy

8.8 Construction Insurance, Professional liabilities insurance and its claim

8.9 Claim or variations in construction and their management

9. **Estimating and Costing**

9.1 Types of estimates and their specific uses Concept of estimates, their types and specific uses

9.2 Methods of estimating: Taking out quantities of various civil works, their bill of quantities and abstract of cost

9.3 Procedure of estimating, building estimates, estimates of other civil engineering structures (main items not covered in building estimates)

9.4 Key components of estimating norms and rate analysis, their types and importance

9.5 Specification of various Civil works: Purpose, type, necessity; Specification preparation and checking to task specific purposes, Preparation of bill of quantities
9.6 Valuation of Civil Works: Purpose, principle and methods
9.7 Purpose, principles and methods of valuation of civil engineering structures
9.8 Procurement of Goods, Works and consulting services
9.9 Procurement Guidelines; Standard Bidding Documents

10. **nea and miscelleneous**

10.1 Organizational structure and function of NEA, various power plants of Nepal: Their types, silent features, and geographical locations
10.2 Power transmission system, voltage levels, lengths, export-import links for power exchange with India
10.3 Occurrence and distribution of rainfall in Nepal, Hydrological cycle of Nepal. Measurement of rainfall, Factor affecting rainfall, Measurement of stream discharges, Factor affecting stream run-off. Precipitation characteristics Catchment characteristics and analysis of rainfall data, Design discharge and Flood discharge, flooding events and its probable effects in hydropower plants
10.4 Slope stability of Hydropower construction sites: Head-works sites, conveyance sites, Power house sites. Ground water table and its effects in hydropower construction, Stability analysis of water storage structures (over turning, sliding, crushing and uplift)
10.5 Safety measures against probable site accidents and electric shocks, basic knowledge of first aid
10.6 Environment Protection Scheme for Hydropower Plant