

## नेपाल विद्युत प्राधिकरण

प्राविधिक सेवा, सबै समूह/उपसमूह, तह ७, विभिन्न पदको लागि खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पाठ्यक्रम योजनालाई निम्नानुसारका दुई चरणमा विभाजन गरिएको छ ।

**प्रथम चरण:** लिखित परीक्षा पूर्णाङ्क :- २००

**द्वितीय चरण:** अन्तर्वार्ता पूर्णाङ्क :- ३०

### १. प्रथम चरण: लिखित परीक्षा (Written Examination) पूर्णाङ्क :- २००

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	खण्ड	परीक्षा प्रणाली		प्रश्नसंख्या × अङ्क	समय
प्रथम	सामान्य ज्ञान र बौद्धिक ज्ञान	१००	४०	(क)	वस्तुगत	बहुवैकल्पिक प्रश्न (MCQ)	५० प्रश्न * १ अङ्क	४५ मिनेट
	(ख)			विषयगत	छोटो उत्तर आउने प्रश्न	६ प्रश्न * ५ अङ्क	१ घण्टा	
					लामो उत्तर आउने प्रश्न	२ प्रश्न * १० अङ्क	३० मिनेट	
द्वितीय	सेवा सम्बन्धी विस्तृत ज्ञान	१००	४०	(क)	विषयगत	छोटो उत्तर आउने प्रश्न	२ प्रश्न * ५ अङ्क	३ घण्टा
						लामो उत्तर आउने प्रश्न	४ प्रश्न * १० अङ्क	
				(ख)		छोटो उत्तर आउने प्रश्न	२ प्रश्न * ५ अङ्क	
						लामो उत्तर आउने प्रश्न	४ प्रश्न * १० अङ्क	

### २. द्वितीय चरण: अन्तर्वार्ता (Interview) पूर्णाङ्क :- ३०

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	३०	मौखिक

#### द्रष्टव्य :

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ ।
- प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- लिखित परीक्षामा सोधिने प्रश्नसंख्या र अङ्कभार यथासम्भव सम्बन्धित पत्र / विषयमा दिईए अनुसार हुनेछ ।
- वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको गलत उत्तर दिएमा प्रत्येक गलत उत्तर वापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस वापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
- वस्तुगत बहुवैकल्पिक हुने परीक्षामा परीक्षार्थीले उत्तर लेख्दा अंग्रेजी ठूलो अक्षर (Capital Letter ) A,B,C,D मा लेख्नुपर्नेछ । सानो अक्षर (Small Letter) a,b,c,d लेखेको वा अन्य कुनै सङ्केत गरेको भए सबै उत्तरपुस्तिका रद्द हुनेछ ।
- बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
- विषयगत प्रश्नहरूको हकमा एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिनेछ ।
- विषयगत प्रश्न हुने पत्र/विषयका प्रत्येक खण्डका प्रश्नका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ ।
- यस पाठ्यक्रम योजना अन्तर्गतका पत्र/ विषय विषयवस्तुमा जुनसुकै कुरा लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम, विनियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगाडी (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ ।
- प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
- पाठ्यक्रम स्वीकृत मिति :- २०८०/०८/२१

**प्रथम पत्र**

**खण्ड (क) सामान्य ज्ञान र बौद्धिक परीक्षण: ५० अङ्क**

**1. सामान्य ज्ञान: (३०x १ = ३० अङ्क)**

- 1.1 नेपालको भूगोल र आर्थिक तथा सामाजिक क्रियाकलाप: धरातलीय स्वरूपको किसिम र विशेषता, नेपालमा पाईने हावापानीको किसिम र विशेषता, नदीनाला, तालतलैया, खनिज पदार्थ, प्राकृतिक स्रोत साधन, विद्युत, शिक्षा, स्वास्थ्य र सञ्चारसम्बन्धी जानकारी
- 1.2 नेपालको सामाजिक एवं सांस्कृतिक अवस्था: प्रथा, परम्परा धर्म, जातजाति, भाषाभाषी, कला, संस्कृति र साहित्य
- 1.3 नेपालमा विद्युत विकास, उर्जाका स्रोत र सम्भावना
- 1.4 नेपालको संघीय, प्रादेशिक र स्थानीय संरचना तथा शासन प्रणाली सम्बन्धी जानकारी
- 1.5 विश्वको भूगोल: महादेश, महासागर, अक्षांश, देशान्तर, अन्तर्राष्ट्रिय तिथि रेखा, समय, पर्वतश्रृङ्खला, नदी, हिमनदी, ताल, हिमताल
- 1.6 अन्तर्राष्ट्रिय सम्बन्ध तथा संघ/ संस्था: संयुक्त राष्ट्र संघ र यसका एजेन्सीहरू (UNO and Its Agencies) दक्षिण एशियाली क्षेत्रीय सहयोग संगठन (SAARC) सम्बन्धी जानकारी
- 1.7 राष्ट्रिय तथा अन्तर्राष्ट्रिय महत्वका समसामयिक घटना तथा नविनतम गतिविधिहरू

**2. बौद्धिक परीक्षण: (२०x १ = २० अङ्क)**

**2.1 Verbal and Non-verbal Aptitude:**

Vocabulary, Alphabetical ordering of words, Classification, Coding-Decoding, Insert the missing character, Direction and Distance sense test, Ranking order test, Relationship Test, Logical sequence of words, Common sense test, Assertion and Reason, Logical reasoning, Figure series, Figure analogy, Figure Classification, Figure Matrix, Pattern completion/finding, Construction of squares and triangles, Analytical reasoning.

**2.2 Numerical Ability and Quantitative Aptitude**

Arithmetical reasoning, Insert the correct mathematical signs, Decimal and Fraction, Percentage, Ratio, Average, Profit and Loss, Time and work.

**खण्ड (ख) संस्थागत एवं सामाजिक मामिला: ५० अङ्क**

**1. Constitution, Act and Rules**

- 1.1. Constitution of Nepal
- 1.2. Nepal Electricity Authority Act, 2041
- 1.3. Electricity Regulatory Commission Act, 2074
- 1.4. Electricity Act, 2049 and Electricity Regulation, 2050
- 1.5. Public Procurement Act, 2063 and Regulations, 2064
- 1.6. Nepal Electricity Authority, Present Financial Administration bylaws
- 1.7. Nepal Electricity Authority, Present Employee Service bylaws
- 1.8. Corruption Control Act, 2059
- 1.9. Good Governance (Management and Operation) Act, 2064
- 1.10. Land Acquisition Act, 2034
- 1.11. Environment Protection Act, 2076 and Environment Protection Regulation, 2077

**2. Electricity Development in Nepal**

- 2.1 History of power development in Nepal; Energy supply demand trends
- 2.2 Recent trends in power sector reform; Hydropower potential of Nepal and prospects and challenges for its development
- 2.3 Nepal Electricity Authority: objective, functions, corporate structure, achievement and challenges
- 2.4 Concept of NEA Restructuring in federal context
- 2.5 Reliable and Equality Electricity Services in Administration Development (Nepal: Prospects and Challenges)

**3. Development**

- 3.1 General concept of development administration
- 3.2 Planning in Nepal: efforts, achievement and challenges
- 3.3 Sustainable Development
- 3.4 Public Private Partnership
- 3.5 General Concept of Public Administration and its Function

**4. Management and Financial Analysis**

- 4.1 Concept of Management
- 4.2 Motivation, Leadership, Control, Coordination and Team work, Decision making
- 4.3 Corporate planning and strategic management
- 4.4 Corporate social responsibility
- 4.5 Project management: Use of network models- CPM, PERT, human resource planning and resource scheduling; project monitoring and control; project control cycle
- 4.6 Financial analysis: Methods of financial analysis such as benefit cost ratio, internal rate of return (EIRR and FIRR), net present value, payback period, minimum attractive rate of return and their application; tariff structure

**5. New Trends of Power Sector**

- 5.1 Various Sources of Energy: trend, possibilities and challenges
- 5.2 Role of IPP (Independent Power Producer), opportunities and challenges
- 5.3 Power Purchase Agreement (PPA), Power development agreement (PDA)
- 5.4 Concept of energy exchange pool market, energy banking
- 5.5 Regional and sub-regional interconnections with Nepalese grid

द्वितीय पत्र:

**सेवा सम्बन्धी विस्तृत ज्ञान**

**खण्ड (क) ५० अङ्क**

1. **Electrical Engineering Fundamentals**
  - 1.1 Electric charge and current, direct and alternating currents, electric voltage, potential difference, power and energy
  - 1.2 Ohm's Law, Kirchhoff's Law; Star/ Delta and Delta/Star transformation
  - 1.3 Network theorems; superposition theorem, maximum power transfer theorem, Thevenin's theorem and Norton's theorem
  - 1.4 Inductance and Capacitance in AC circuits; voltage and currents in circuit elements, equivalent inductance and capacitance computations
  - 1.5 AC system analysis: concept of phase difference, active and reactive power, complex power, power triangle, power factor, resonance in AC circuits
  - 1.6 Three phase systems; balanced and unbalanced systems, voltage current relations and computation of power in three phase systems
  - 1.7 Network analysis: Laplace Transform in Circuit Analysis; Transfer Function, Transients in electrical circuits; natural and step response of RL and RC and RLC Circuits, Operational Amplifiers; Inverting and Non-inverting Amplifier Circuits, Two port networks, reciprocity theorems
2. **Electrical Machines**
  - 2.1 Magnetic Circuits: Flux and flux linkage, inductance and energy; magnetic materials and their properties; magnetically induced emf and force; AC operation of magnetic circuits; hysteresis and eddy current losses
  - 2.2 Transformers: Equivalent circuits; losses and efficiency; efficiency curves; energy efficiency; regulation; grounding; transformer connections; parallel operation; overloading capacity; temperature rise; auto-transformer and instrument transformers, Testing of transformers and their parameters
  - 2.3 DC Machines: Working principles; types; operating characteristics; armature reaction; losses and efficiency; applications, starting and speed control of DC motors
  - 2.4 Synchronous Machines: Working principles; operating characteristics; losses and efficiency; steady state and transient equivalent circuits; excitation system and requirement, governor principle; parallel operation; hunting phenomenon.
  - 2.5 Induction Machines: Working principles; operating characteristics during motoring and generating mode; losses and efficiency; equivalent circuits; starters; speed control and motor selection
3. **Power Generation**
  - 3.1 Hydroelectric Power Plants: Merits and demerits; site selection; classification; elements of hydroelectric power plant and schematic layouts; different types of water turbines; efficiency curves; selection of water turbines; essential features of hydroelectric alternators; choice of size and number of generating units; auxiliaries in hydroelectric plant; Nepalese power plants, their types, salient features and locations
  - 3.2 Diesel Electric Power Plants: Construction and operating principles; merits and demerits; application; site selection; schematic arrangement; performance and thermal efficiency

- 3.3 Non-conventional and Renewable Power Generation: Micro hydro, solar photovoltaic, wind, geothermal and tidal power generation schemes and their significance
- 3.4 Economics of power generation: Concept of load curve; load duration curve; mass curve; demand factors; plant factor; utilization factor and plant use factor; significance of load factor and diversity factor in generation planning
- 4. **Transmission and Distribution**
  - 4.1 Transmission: Choice of voltage; conductor size; insulators used in overhead lines; vibration dampers; conductor configuration; clearances; span lengths; sag-tension calculation; pole/tower types; right of way
  - 4.2 Line parameters computations, Performance of short, medium and long transmission lines; ABCD constants; surge impedance loading, Ferranti effect.
  - 4.3 Corona phenomenon: Factors affecting corona and its disadvantages; corona power loss, audible noise and radio interference
  - 4.4 Inductive interference between power and communication lines
  - 4.5 Distribution Systems: Distribution feeders; conductor size; route selection; pole types; distribution substations; bus bar schemes; effect of load power factor and power factor correction; reactive power compensation; distribution system protection devices; distribution system reliability indices; transformer oil; consumer supply connection; metering system
- 5. **Power System Analysis**
  - 5.1 **Load Flow Study:** Load characteristics, effects on voltage and frequency, real power frequency balance, reactive power frequency balance, basic complex power flow equations for a network, voltage profile and VAR compensation, causes and effects of low power factor, advantages and methods of power factor improvement
  - 5.2 **Stability:** Steady state, dynamic and transient stability, equal area criterion, Swing equation for multi machine, Steady-state stability implications, maximum steady state power flow condition
  - 5.3 **Control and Protection:** Faults in power system and their calculation, symmetrical and unsymmetrical faults, components of power system protection, Isolators/Disconnecting switches, contactors, types and characteristics of circuit breakers and protective relays, automatic reclosure, protection of generators, transformers and transmission/distribution lines, lightning protection, Governor's principle and characteristics
  - 5.4 **Load dispatching:** principle of economic load dispatch, requirements, tools and benefits, role of a dispatcher
  - 5.5 **Transmission System:** Choice of voltage, route selection, right of way, substation layout and location
  - 5.6 **Distribution System:** Types of distribution systems, distribution substations, bus bar schemes, power factor correction, protection coordination in distribution systems, distribution system reliability indices, rural distribution system and loss reduction
  - 5.7 **Quality of Electricity:** Supply quality parameters, effect of quality on equipment and application, standards

6. **Power Electronics**

- 6.1 Power electronics devices; Diode, power transistors, MOSFET, thyristors, GTO, IGBT
- 6.2 Rectifiers; uncontrolled and controlled rectifiers, operation with inductive loads, harmonic filtering, half wave and full wave rectifier circuits and the output waveforms
- 6.3 Inverters: basic details and operation of inverters; voltage source and current source inverters, harmonic filtering
- 6.4 DC choppers; cyclo-converters; AC voltage controllers
- 6.5 Introduction to HVDC transmission lines; advantages and disadvantages, applications

**खण्ड (ख): ५० अङ्क**

7. **Switchgear and Protection**

- 7.1 Types of protective relays; working principle and application, electromagnetic, static and digital relays
- 7.2 Protection of generators, transformers and transmission and distribution lines;
- 7.3 Circuit Breakers: Construction and operating principles of ACB, OCB, VCB, ABCB and SF6 circuit breakers and their applications
- 7.4 Over voltage computations, Protection against switching over voltage and lightening, surge arrestors and their applications
- 7.5 Substations; classification; indoor and outdoor substations; selection and location of site; bus bar arrangements; substation switchgear; substation earthing

8. **Power Distribution and Consumer Services**

- 8.1 Sub-station & Switchyards: General layout of Sub-station and their key elements
- 8.2 Types of underground cable, cable resistances and capacitances, insulation resistance, selection of cable and selection criteria
- 8.3 Handling of cable and protection, cable joints, single wire power distribution.
- 8.4 Lightening phenomenon, lightening arrestors types and function, overhead earth wire, voltage drops, Ferranti effects, SIL of Transmission Line
- 8.5 Earthing of electrical system and electrical equipment. its importance and methods of earthing

9. **Economics of Power Utilization**

- 9.1 Basic concept about Energy Audit
- 9.2 Load management, TOD meter, Demand side management
- 9.3 Power Factor Improvement: Causes and effects of low power factor, advantages and methods of power factor improvement.
- 9.4 Load forecast, demand factor, load factor, plant use factor, diversity factor, depreciation, Rate of Return
- 9.5 Energy Tariffs structure

10. **Safety Engineering**

- 10.1 Effects of electric shock on human beings, first aid requirements, safety and precautions against electric shocks; safety rules and regulation

## नेपाल विद्युत प्राधिकरण

प्राविधिक सेवा, इलेक्ट्रिकल समूह/ उपसमूह, तह- ७ इञ्जिनियर पदको खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

- 10.2 Common safety tools and devices for electric utility technician; Technical Standards and performance test of safety tools and devices, significance live line maintenance and relevant precautionary measures
  - 10.3 Earthing and shielding techniques; earth resistance and resistivity measurements
  - 10.4 Fire hazards; firefighting techniques and equipment for electric utility
11. **Instrumentation and Control**
- 11.1 Electrical measurements: Classification, working and applications of indicating, recording and integrating instruments for electrical measurements, Analog-digital and Digital-analog converters, concept of precision and error
  - 11.2 Sensors and transducers: Sensors and transducers for speed, position, fluid flow and temperature
  - 11.3 Automatic feedback control system; time and frequency response of first and second order systems, pole and zero concept, stability criterion, root locus, and bode plots
  - 11.4 PID Controller; controlling the transient response and steady state error
12. **Tested Lab of Electrical Machine and Equipment**
- 12.1 Technical Standards
  - 12.2 Accreditation of Lab
  - 12.3 Calibration of Testing devices