

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

पाठ्यक्रम योजनालाई निम्नानुसार दुई चरणमा विभाजन गरिएको छः

प्रथम चरण:- लिखित परीक्षा पूर्णाङ्क:- २००
द्वितीय चरण:- अन्तर्वार्ता पूर्णाङ्क:- ३०

परीक्षा योजना (Examination Scheme)

प्रथम चरण: लिखित परीक्षा

पूर्णाङ्क:- २००

पत्र	विषय	पूर्णाङ्क	उतीर्णाङ्क	खण्ड	परीक्षा प्रणाली	प्रश्नसंख्या * अङ्कभार	समय
प्रथम	व्यवस्थापकीय ज्ञान	१००	४०	क	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 सम्बन्धी (विस्तृत ज्ञान)	१००	४०	क	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 चरण:- अन्तर्वार्ता

पूर्णाङ्क:- ३०

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	३०	मौखिक

द्रष्टव्यः

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ।
- प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टा छुट्टै हुनेछ।
- लिखित परीक्षामा सोधिने प्रश्नसंख्या र अंकभार यथासम्भव सम्बन्धित पत्र/विषयमा दिईए अनुसार हुनेछ।
- वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको गलत उत्तर दिएमा प्रत्येक गलत उत्तरवापत २० प्रतिशत अंक कट्टा गरिनेछ। तर उत्तर नदिएमा त्यसवापत अंक दिईने छैन र अंक कट्टा पनि गरिने छैन।
- वस्तुगत बहुवैकल्पिक हुने परीक्षामा परीक्षार्थीले उत्तर लेखदा अंग्रेजी ठुलो अक्षर (Capital Letter) A,B,C,D मा लेख्नु पर्नेछ। सानो अक्षर (Small Letter) a,b,c,d लेखेमा वा अन्य कुनै संकेत गरेको भए सबै उत्तरपुस्तिका रद्द हुनेछ।
- बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाईने छैन।
- विषयगत प्रश्नहरूको हकमा 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/विषयमा प्रत्येक खण्डका प्रश्नका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन्। परीक्षार्थीले प्रत्येक खण्डका प्रश्नको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नु पर्नेछ।
- यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जुन सुकै कुरा लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम, विनियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्नेछ।
- प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारलाई मात्र दोश्रो चरणको परीक्षामा सम्मिलित गराईनेछ।
- पाठ्यक्रम स्वीकृत मिति:- २०८०/०८/२१

नेपाल विद्युत प्राधिकरण
प्राविधिक सेवा, सबै समूह/उपसमूह, तह ७ ईन्जिनियर पदको लागि आन्तरिक
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम
प्रथमपत्र : 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 चुनौतीहरू
 - १.५ संघीय अवधारणा अनुसार नेपाल विद्युत प्राधिकरणको पुनःसंरचना
 - १.६ आवधिक योजनामा उर्जा विकास सम्बन्धी व्यवस्था
 - १.७ दिगो विकास र वातावरण
 - १.८ विद्युतका नियामक निकायहरूको 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 स्रोतहरू
 - 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 चुनौतिहरू
 - १.१३ Energy Efficiency and Demand side Management
 - १.१४ Energy Exchange, Energy Trading, Energy Banking, Energy Pool Market, Regional Grid
२. संविधान, ऐन, नियम तथा विनियमहरू
 - 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, सबै 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, ईलेक्ट्रिकल समूह/उपसमूह, तह ७, इन्जिनियर पदको लागि आन्तरिक
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम
द्वितीयपत्र
सेवा सम्बन्धी विस्तृत ज्ञान
खण्ड (क) - ५० अङ्क

1. Electrical Engineering Fundamentals

- 1.1 DC circuits: Ohm's law, electric voltage current, resistance and resistivity, temperature dependence of resistance, power and energy, conductors, semiconductors and insulating materials, concept of voltage and current sources
- 1.2 Series and parallel electric circuits, star-delta and delta-star transformation, Kirchhoff's laws
- 1.3 Linear and non-linear circuit, bilateral and unilateral circuits, active and passive circuits
- 1.4 Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem
- 1.5 Magnetic circuits: Flux and flux linkage, inductance and permeability; energy stored; magnetic materials and their properties; magnetically induced emf and force
- 1.6 Alternating current fundamentals: Principle of generation of alternating voltages and currents and their equations and waveforms, average, peak and rms values
- 1.7 Analysis of R-L, R-C, R-L-C series and parallel circuits, resonance in AC series and parallel circuit, active and reactive power in R-L-C AC circuits
- 1.8 Three phase system: star and delta connection, relation between voltage and currents in star and delta connections, concept of line and phase voltages and currents, neutral and its significance, effect of unbalanced load on a three phase system

2. Electrical Machines

- 2.1 Concept of magnetic circuits; hysteresis and eddy current losses
- 2.2 Transformers: Core and shell type transformers, constructional details of transformers; material for transformer cores, conservators, breather, explosion vent, bushings, transformer oil, no-load and full load operation of transformers, Equivalent circuits, transformer tests: conditions, procedures and outcomes, losses and efficiency, condition for maximum efficiency, three phase transformer connections; parallel operation of transformers; transformer capacity; temperature rise; Tap changing
- 2.3 DC Machines: construction details; yoke poles, windings, carbon brushes and commutator, Working principles; operating characteristics of different types of DC generators and motors, armature reaction; losses and efficiency; applications, starting and speed control of DC motors
- 2.4 Synchronous Generators: Construction and working principle, armature and field winding, excitation systems, equation of induced E.M.F., speed and frequency correlation, voltage and frequency regulation, power and energy losses and efficiency, parallel operation and synchronization, alternators connected to infinite bus bars
- 2.5 Synchronous Motors: Working principle, application, starting methods, V-curve and inverted V curve
- 2.6 Three phase Induction Motors: construction detail, yoke poles, windings, squirrel cage and phase wound type, slip rings, Working principles, equivalent circuits,

नेपाल विद्युत प्राधिकरण
प्राविधिक सेवा, ईलेक्ट्रिकल समूह/उपसमूह, तह ७, इन्जिनियर पदको लागि आन्तरिक
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

torque slip characteristics, effect of rotor resistance, starting methods, no-load and block rotor tests, methods of speed control and motor selection

2.7 Single phase Induction Motors: construction and operating principles, applications

3. Electrical Power Generation

3.1 Hydroelectric power plants: Merits and demerits, classifications and layouts, selection of sites, types of water turbines, their working principles and applications, governors and their applications, Hydro-plant auxiliaries

3.2 Diesel electric power plants: Merits and demerits, selection of sites, elements of a diesel plant and its layout. Basic operating principles

3.3 Non-conventional power generation: Solar PV, Wind, Geothermal, Tidal power generating schemes; resource availability, potential role in a power system

3.4 Excitation systems: DC excitation system, AC excitation system, static excitation system, brushless excitation system

3.5 Automatic voltage regulator: construction and operation

3.6 Starting of Generators: Prerequisites for starting of generators in hydro and diesel station, Necessity of black start generating units in power stations

4. Electrical Measurements

4.1 Ammeter voltmeter method, Kelvin double bridge method, Wheatstone bridge method, Megger

4.2 Inductance and capacitance measurements: Maxwell bridge and Anderson bridge, Schering bridge

4.3 Consumer supply energy meters: Construction and principle of operation, creeping errors and their compensation, testing of energy meters.

4.4 Tarrif schemes in Nepal: simple tariff, two part tariff

4.5 Maximum demand meter: construction and operating principle, applications

4.6 Indicating, recording, measuring instruments, construction and operation of analog and digital measuring instruments

4.7 Ammeter and voltmeter, Shunts and multipliers, multi-range meters

4.8 Measurement of power: ammeter-voltmeter method and wattmeter for 1-phase circuits; two watt meter method for three phase circuits

खण्ड (ख) - ५० अङ्क

5. Sub-Stations

5.1 Substations classification: Indoor and outdoor substations, generating station substation, switching substation, area substation and distribution substation

5.2 General layout of substation, components of substation, busbar arrangements, earthing of equipments in a substation

5.3 Cabling in substations, busbar reactors

5.4 CT and PT: construction and operation for measurement and protection

5.5 Circuit Breakers: classification, construction and working principle of air break, vacuum, SF₆, air blast and oil CBs; specification, rating and selection of CBs; testing.

5.6 Fuse, MCB, MCCB, ELCB and RCCB: construction, working and applications

5.7 Over current, earth fault and under voltage relays, isolators and contactors

5.8 Protection schemes: Overload and short circuit protection, earth fault protection, differential protection, distance protection

5.9 Lightning protection: lightning arrestor, types, function; overhead earth wire

नेपाल विद्युत प्राधिकरण
प्राविधिक सेवा, ईलेक्ट्रिकल समूह/उपसमूह, तह ७, इन्जिनियर पदको लागि आन्तरिक
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

- 5.10 Power stations auxiliaries; storage batteries, their capacities, operating cycles, maintenance
 - 5.11 Power line carrier communication and its significance in power system
 - 5.12 Voltage control: Tap changing in transformer, booster transformer, synchronous condenser and static compensator
- 6. Transmission and Distribution Lines**
- 6.1 Overhead transmission line and underground power cables
 - 6.2 Necessity of high voltage transmission, choice of voltage level, conductor size and spacing, classifications, insulation used
 - 6.3 Line parameter calculation, modeling and analysis of short and medium length transmission lines
 - 6.4 Sag, tension and clearances, supports and cross arms, insulators
 - 6.5 Jumpers and vibrations dampers in transmission lines
 - 6.6 Need for surveying and leveling in overhead line construction, distance measurement, principle factors in routing overhead transmission lines, leveling survey and pegging of the route
 - 6.7 Primary distribution system: Radial system, ring main system and interconnected network system
 - 6.8 Secondary distribution system: Three phase four wire distribution, single phase two wire distribution: Selection of supports and conductors in secondary distribution system, stay wire, insulators
 - 6.9 Voltage regulation in distribution system, concept of reactive power compensation
 - 6.10 Live-line maintenance: procedure, safety measures
- 7. Utilization of Electrical Energy**
- 7.1 Illumination: radiant energy and radiant efficiency, luminous flux, luminous intensity, construction and working principle of incandescent lamps, fluorescent lamps, CFL, LED, lighting scheme, lamps for street lighting
 - 7.2 Power electronics devices: construction and characteristics of power diode, Thyristors, GTO, TRIAC
 - 7.3 Rectifier: arrangements for half wave and full wave rectification, their operation, form factor, ripple factor, basic concept of three phase rectifier
 - 7.4 Inverter: construction and basic operating principle, output wave forms, applications
 - 7.5 Chopper: operation of step up and step down choppers, output wave form, average output voltage
 - 7.6 Industrial drives: individual and group operation, selection of motors, electrical and mechanical characteristics required for lathe machine, textile machine, milling machine, rolling machine, paper industry, cement factory, steel industry
 - 7.7 Domestic drive: characteristics of motors for sewing machine, vacuum cleaner, mixer, washing machine, grinding machine
 - 7.8 Electric Traction: DC and AC motors application for traction, starting method and speed control of electric motors for tramway, trolley bus, electric train, elevators
- 8. Power System Operation and Maintenance**
- 8.1 Concept of demand factor, diversity factor, load factor and load curves, load duration curves, power factor correction and improvement
 - 8.2 Operation of substation during normal and abnormal condition
 - 8.3 Synchronization and system restoration procedure

नेपाल विद्युत प्राधिकरण
प्राविधिक सेवा, ईलेक्ट्रिकल समूह/उपसमूह, तह ७, इन्जिनियर पदको लागि आन्तरिक
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

- 8.4 Preventive maintenance in electrical power system for transmission lines and its equipment, distribution lines and its equipments, transformers, switchgears, motors, generators, turbines excitation system, and communication system used in power system, effect of maintenance on capacity and number of generating unit selection.
 - 8.5 D.C. system and its maintenance
 - 8.6 Electrical safety: Safety guidelines, rules and regulations for working personnels; safety tools, devices and their applications
9. **Miscellaneous**
- 9.1 Energy efficiency or demand side management
 - 9.2 Energy exchange, trading, energy pool market and regional grid
 - 9.3 Technical standards and as-built drawing or design