

# नेपाल विद्युत प्राधिकरण

प्राविधिक सेवा, ईलेक्ट्रिकल समूह, ईलेक्ट्रिकल उपसमूह, तह-७ ईन्जिनियर पदको  
खुल्ला प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

- शैक्षिक योग्यता: प्रचलित कर्मचारी सेवा विनियमावलीमा व्यवस्था भए अनुसार ।
- लिखित परीक्षाको विषय, पूर्णाङ्क, परीक्षा प्रणाली, प्रश्नसंख्या, अंकभार र समय निम्नानुसार हुनेछ ।

पत्र	विषय	पूर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या	प्रति प्रश्न अंकभार	समय
प्रथम	जनरल इलेक्ट्रिकल ईन्जिनियरिङ्ग	३०	वस्तुगत बहुउत्तर	३०	१	३० मिनेट
द्वितीय	पावर सिष्टम ईन्जिनियरिङ्ग	७०	विषयगत	छोटो उत्तर	८	५
				लामो उत्तर	३	१०

- वस्तुगत बहुउत्तर परीक्षा प्रणाली प्रश्नको उत्तर लेख्दा केरमेट गरेको, दोहोरो लेखेको, सच्याएको, निर्दिष्ट स्थानभन्दा अन्यत्र लेखेको वा उत्तर नै सारेकोलाई गल्ती मानिनेछ ।
- वस्तुगत बहुउत्तर परीक्षा प्रणाली प्रश्नमा प्रत्येक गलत उत्तर वापत सो प्रश्न वापत पाउने अंकको ०.२ (बीस प्रतिशत २०%) का दरले सो विषयमा पाएको कुल प्राप्तांकबाट घटाईनेछ ।
- कालो/नीलो मसी मात्र भएको डटपेन/कलमले उत्तरको लागि निर्धारित कोठाका प्रश्नमा क,ख,ग,घ मध्ये एउटा मात्र सहि उत्तर स्पष्ट रूपले लेख्नुहोला । पेन्सिलले लेखेकोलाई मान्यता दिइने छैन ।
- प्रथम र द्वितीयपत्रको परीक्षा २ पटक गरेर हुनेछ । प्रथमपत्रको परीक्षा सकिएपछि द्वितीयपत्रको परीक्षा तत्काल हुनेछ ।
- द्वितीयपत्रको लिखित परीक्षाको माध्यम नेपाली वा अंग्रेजी भाषा हुनेछ ।
- सामान्यतः प्रत्येक शिर्षकको अंकभार तोकिए बमोजिम हुनेछ ।

## प्रथम पत्र: जनरल ईलेक्ट्रिकल ईन्जिनियरिङ्ग [30]

### 1. GENERAL: [1×2]

- Recent trends in power sector reform; Hydropower potential of Nepal and prospects and challenges for its development.
- Legal provisions: Electricity act, 2049, Electricity regulation, 2050, Hydropower development policy, 2058 and NEA act, 2041.

### 2. BASIC ELECTRICAL ENGINEERING: [1×5]

- Magnetic circuits: 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.
- AC fundamentals: Phasor representation; series and parallel AC circuits; waveforms and harmonics; power in single phase AC circuits; complex power; voltage, current and power in balanced three phase circuits; per unit quantities; load characteristics.
- Electrical measurements: Classification, working and applications of indicating, recording and integrating instruments for electrical measurements.

### 3. ELECTRICAL MACHINES: [1×6]

- Transformers: Equivalent circuits; losses and efficiency; efficiency curves; energy efficiency; regulation; grounding; transformer connections; parallel operation; overloading capacity; temperature rise; auto-transformer and instrument transformer.
- DC Generators: Working principles; types; operating characteristics; armature reaction; losses and efficiency; applications.
- DC Motors: Working principles; types; operating characteristics; losses and efficiency; starting and speed control; applications.
- Synchronous machines: Working principles; operating characteristics; losses and efficiency; steady state and transient equivalent circuits; excitation system and requirement, governor principle; parallel operation; hunting.

- Induction Machines: Working principles; operating characteristics of motoring and generating mode; losses and efficiency; equivalent circuits; starters; speed control and motor selection.
4. POWER PLANTS: [1×4]
    - Types and layouts of hydropower plants; advantages and disadvantages; turbines types and their application; principle, layout, characteristics, cost and environmental impact of diesel, steam, combined cycle, solar photovoltaic, wind and micro hydro power plants .
  5. POWER SYSTEM: [1×5]
    - Load flow studies; voltage profile; VAR compensation; real power-frequency balance; reactive power-voltage balance; economic load dispatch.
    - Power system stability: Steady state, dynamic and transient stability; swing equation; equal area criterion.
    - Switchgear and protection: Functional characteristics of protective relays, their types and working principles; working principles of different types of circuit breakers; lightning protection; power line carrier control.
    - Transmission: Choice of voltage; conductor size; spacing; sag-tension calculation; pole/tower types; right of way; substation location; layout and bus bar schemes.
    - Distribution: Distribution feeders; conductor size; route selection; pole types; distribution substations; bus bar schemes; power factor correction; distribution system protection devices; definition of distribution system reliability indices; transformer oil; consumer supply connection; metering system.
  6. POWER ELECTRONICS: [1×4]
    - Introduction to power diodes, transistors, thyristors and their application in power system; thyristor turn on and turn off mechanisms; gate turn on devices; current and harmonic filtering; DC choppers; cycloconverters; AC voltage controllers.
  7. SAFETY ENGINEERING: [1×3]
    - Physical effects of electric shock; safety and precaution; safety rules and regulation; safety tools and devices for electricity; live line maintenance and precautions; earthing and shielding techniques; fire hazards; fire fighting techniques and equipment; first aid requirements after electrical accidents.

### द्वितीयपत्र: पावर सिस्टम इंजिनियरिंग [70]

1. GENERAL: [5×1]
  - History of power development in Nepal; energy supply demand trends; challenges and prospects of hydropower development; Role of HMG institutions; NEA and private sectors in power development; NEA organizational structure and functions of different business groups; concept of deregulation.
2. GENERATION: [10×1]
  - 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.
  - Diesel Electric Power Plants: Merits and demerits; application; site selection; elements of a diesel plant and its schematic arrangement; performance and thermal efficiency.
  - Non conventional method of power generation: Micro hydro, solar photovoltaic, wind and geothermal method of power generation and their importance.

- Concept of load curve; load duration curve; mass curve; demand factor; plant factor; utilization factor and plant use factor; significance of load factor and diversity factor in generation planning.
3. AC MACHINES [5×2]
- Transformers: Equivalent circuits; losses and efficiency; efficiency curves; energy efficiency; regulation; grounding; transformer connections; parallel operation; overloading capacity; temperature rise; auto-transformer and instrument transformer.
  - Synchronous Machines: Working principles; operating characteristics; losses and efficiency; steady state and transient equivalent circuits; excitation system and requirement, parallel operation, hunting.
  - Induction Machines: Working principles; operating characteristics of motoring and generating mode; losses and efficiency; equivalent circuit; starters; speed control and motor selection.
4. TRANSMISSION AND DISTRIBUTION: [10×1]
- A.C. transmission: Performance of short, medium and long transmission lines; ABCD constants; advantages and limitations of high voltage transmission; choice of working voltage; conductor size; spacing; supports and cross arms; insulators used in overhead lines; vibration dampers; conductor configuration; clearances; span lengths; sag tension calculation; right of way.
  - Corona phenomenon: Factors affecting corona and its disadvantages; radio interference; inductive interference between power and communication lines.
  - Distribution Systems: Distribution feeders; conductor size; route selection; pole types; distribution substations; bus bar schemes; power factor correction; distribution system protection devices; definition of distribution system reliability indices; transformer oil; consumer supply connection; metering system.
  - Knowledge of Nepalese power transmission system: voltage levels and length; export-import links for power exchange with India.
5. SWITCHGEAR AND PROTECTION: [10×1]
- Protection: Types of protection; types of protective relays; working principle and application; Types and characteristics of circuit breakers and their comparison; protection of generators, transformers and transmission and distribution lines; protection against over voltage and lightning.
  - Fault calculations: Types of faults; symmetrical components; sequence impedances; short circuit current and fault calculations.
6. SUBSTATIONS: [5×1]
- Classification; indoor and outdoor substations; selection and location of site; bus bar arrangements; substation switchgear; substation earthing.
7. LOAD FLOW STUDIES AND VOLTAGE CONTROL: [5×1]
- Load flow studies: Bus classification; load flow equations; Gauss Seidel and Newton Raphson methods of load flow solutions.
  - Voltage control: Necessity of voltage control; methods of voltage control.
8. INTERCONNECTED SYSTEM CONTROL [5×1]
- Parallel operation of alternators; synchronous machines on infinite bus bars; economic load dispatch in interconnected system; penalty factor; load frequency control; voltage and reactive power control.

9. POWER SYSTEM STABILITY: [5×1]

- Steady state, transient and dynamic stability; maximum steady state power flow; swing equation; equal area criterion; critical clearing angle; factors affecting transient stability.

10. PROJECT MANAGEMENT AND FINANCIAL ANALYSIS: [5×1]

- Project management: Use of network models like CPM, PERT, Gantt chart; manpower planning and resource scheduling; project monitoring and control; project control cycle.
- Financial analysis: Methods of financial analysis such as benefit cost ratio, internal rate of return, net present value, payback period, minimum attractive rate of return and their application; Concept of EIRR and FIRR; tariff structure.

