

## चिलिमे जलविद्युत कम्पनी लिमिटेड

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

- शैक्षिक योग्यता: चिलिमे जलविद्युत कम्पनी लिमिटेड कर्मचारी सेवा शर्त विनियमावलीमा व्यवस्था भए अनुसार ।
- लिखित परीक्षाको बिषय, पूर्णाङ्क, परीक्षा प्रणाली, प्रश्न संख्या, अंकभार र समय निम्नानुसार हुनेछ ।

पत्र	विषय	परीक्षा प्रणाली	प्रश्न संख्या	प्रति प्रश्न अंकभार	पूर्णांक	समय	
प्रथम	जनरल ईलेक्ट्रिकल ईन्जिनियरिङ्ग	बस्तुगत बहुउत्तर	३०	०.५	१५	३० मिनेट	
द्वितीय	पावर सिष्टम ईन्जिनियरिङ्ग	बिषयगत	लामो उत्तर	२	१०	७०	२ घण्टा ३० मिनेट
			छोटो उत्तर	१०	५		

- बस्तुगत बहुउत्तर परीक्षा प्रणालीमा प्रत्येक पश्नका चार वटा सम्भाव्य उत्तर दिइने छ । प्रश्नको उत्तर लेख्दा केरमेट नगरेको, दोहोरो लेखेको, सच्याएको, निर्दिष्ट स्थानभन्दा अन्यत्र लेखेको वा उत्तर नै सारेकोलाई गल्ती मानिनेछ ।
- प्रत्येक गलत उत्तर वापत सो प्रश्न वापत पाउने अंकको ०.२ (बीस प्रतिशत २०%) का दरले सो बिषयमा पाएको कूल प्राप्तांकबाट घटाईनेछ ।
- कालो/नीलो मसी मात्र भएको डटपेन/कलमले उत्तरको लागि निर्धारित कोठाका पश्नमा 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 । प्रथम पत्रको परीक्षा सकिएपछि द्वितीयपत्रको परीक्षा तत्काल हुनेछ ।
- द्वितीयपत्रको लिखित परीक्षाको माध्यम नेपाली वा अंग्रेजी भाषा हुनेछ ।

### प्रथमपत्र - जनरल ईलेक्ट्रिकल ईन्जिनियरिङ्ग

#### 1. GENERAL: [0.5×2]

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

#### 2. BASIC ELECTRICAL ENGINEERING: [ 0.5×5]

- 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: [0.5×6]

- Transformers: Equivalent circuits; losses and efficiency; efficiency curves; energy efficiency; regulation; grounding; transformer connections; parallel operation; overloading capacity; temperature rise; auto-transformer and instrument transformers.
- DC Generators: Working principle; types; operating characteristics; armature reaction; losses and efficiency; applications.
- DC Motors: Working principle; types; operating characteristics; losses and efficiency; starting and speed control; applications.
- Synchronous machines: Working principle; operating characteristics; losses and efficiency; steady state and transient equivalent circuits; excitation system and its requirement, governor principle; parallel operation; hunting.
- Induction Machines: Working principle; operating characteristics of motoring and generating mode; losses and efficiency; equivalent circuits; starters; speed control, motor selection for different application.

4. POWER PLANTS: [0.5×4]

- Types and layouts of hydropower plants; advantages and disadvantages; turbine 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: [0.5×6]

- 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 principle; working principle 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: [0.5×4]

- 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: [0.5×3]

- 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; firefighting techniques and equipment; first aid requirements after electrical accidents.

द्वितीयपत्र – पावर सिष्टम ईन्जिनियरिङ्ग [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; Chilime and its subsidiary companies; 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: Construction; Equivalent circuits; Operating characteristics; losses and efficiency; efficiency curves; energy efficiency; regulation; grounding; transformer

connections; parallel operation; overloading capacity; temperature rise; auto-transformer and instrument transformers.

- Synchronous Machines: Working principles; operating characteristics; losses and efficiency; steady state and transient equivalent circuits; excitation system and its requirement, parallel operation and Synchronization, hunting; field of application.
- Induction Machines: Construction; Working principle; 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.

#### 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, Gnatt 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.

