नेपाल विद्युत प्राधिकरण

प्राधिक सेवा, इलेक्ट्रिकल समूह, इलेक्ट्रिकल उपसमूह, तह-७ इन्जिनियर पदको खुला प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

1. शैक्षिक योजना: प्रतियोगिता कर्मचारी सेवा विनियमनीयम व्यवस्था भए अनुसार।
2. लिखित परीक्षाको विषय, पूर्णांक, परीक्षा प्रारंभ, प्रश्नसंख्या, अंकक्षेत्र र समय निम्नानुसार हुनेछ।

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| ३. | बल्लाग बहुउत्तर परीक्षा प्रारंभ प्रश्नको उत्तर लेखा केमेट गर्नुहोस्, दोहरी लेखेको, सचिवालय, निर्देश स्थायित्व अन्य लेखेको वा उत्तर नै सारिकोलाई गली मानिन्छ।
| ४. | बल्लाग बहुउत्तर परीक्षा प्रारंभ प्रश्नको उत्तर बापत सो प्रश्न बापत पाउने अंकको ०.२ (बीस प्रतिशत २०%) का दरले सो क्यापार्नाला कल्पना प्राप्तक्षण घटइन्स।
| ५. | काली गोदल परीक्षा प्रारंभ प्रश्नको उत्तर लागि निर्दिष्ट कोणतो प्रश्नमा केबल गलो।
| ६. | प्रथम र द्वितीयपतकको परीक्षा २ पटक गरेको हुनेछ। प्रथमपतकको परीक्षा सक्षम छ द्वितीयपतकको परीक्षा तक्षक २ पटक गरेको हुनेछ।
| ७. | द्वितीयपतकका लिखित परीक्षाको माध्यम नेपाली वा अंग्रेजी भाषा हुनेछ।
| ८. | सामान्यतया प्रश्नको शिर्षकामुँका अंकभार तीतिको प्रयोग गरिन्छ।

प्रथम पत्र: जनरल इलेक्ट्रिकल इन्जिनियरिङ्ग [३०]

1. GENERAL: [१×२]
   - 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: [१×५]
   - 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: [१×६]
   - 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; lightening 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 lightening.
   • 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.