प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्

पदपूर्ति समिति

सानोठिमी, भक्तपुर ।

प्राविधिक तथा प्रशिक्षण सेवा, इन्जिनियरिङ्ग समूह, इलेक्ट्रिकल उपसमूह

अधिकृतस्तर तृतीय श्रेणी **विद्युत प्रशिक्षक पदको**

खुला र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

सेवा : प्राविधिक तथा प्रशिक्षण	समूह : इन्जिनियरिङ्ग	उपसमूह : इलेक्ट्रिकल
पद : विद्युत प्रशिक्षक	स्तर : अधिकृत स्तर तृतीय श्रेणी	किसिम : खुला/आ.प्र.

पाठ्यक्रमको रुपरेखा : यस पाठ्यक्रमको आधारमा निम्नानुसार दुई चरणमा परीक्षा लिइनेछ :-

प्रथम चरण : लिखित परीक्षा — पूर्णाङ्क : २००

द्वितीय चरण : अन्तर्वार्ता — पूर्णाङ्क : ३०

परीक्षा योजना (Examination Scheme)

१.प्रथम चरणः – लिखित परीक्षा — पूर्णाङ्क :– २००

पत्र	विषय	पूर्णाङ्क	उतीर्णाङ्क	परीक्षा प्रणाली	प्रश्नसंख्याxअङ्क	समय
प्रथम	सामान्य ज्ञान, संस्थागत ज्ञान र सेवा सम्बन्धी	100	40	वस्तुगत - बहुवैकल्पिक प्रश्न (MCQ)	१०० प्रश्न x १ अङ्क	१ घण्टा १५ मिनेट
द्वितीय	सेवा सम्बन्धी	100	40	विषयगत- छोटो उत्तर आउने प्रश्न	८ प्रश्न x ५अङ्क	३ घण्टा
				विषयगत- लामो उत्तर आउने प्रश्न	६ प्रश्न x १०अङ्क	

२. द्वितीय चरण : – अन्तर्वार्ता — पूर्णाङ्क :– ३०

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	30	मौखिक

द्रष्टव्य :

1. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
2. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
3. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
4. 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 ।
5. बहुवैकल्पिक प्रश्न हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
6. परीक्षामा सोधिने प्रश्नसंख्या, अङ्क र अङ्कभार सम्बन्धित पत्र /विषयमा तोकिए अनुसार हुनेछ ।
7. विषयगत प्रश्न हुने पत्रका हकमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । उम्मेदवारले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्ने छ ।
8. यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम 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 पर्दछ ।
9. प्रथम चरणको परीक्षाबाट छनोट भएका उम्मेदवारलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
10. **पाठ्यक्रम लागू मिति :– २०८२।१०।२२**

प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्

पदपूर्ति समिति

सानोठिमी, भक्तपुर ।

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अधिकृतस्तर तृतीय श्रेणी **विद्युत प्रशिक्षक पदको**

खुला र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

प्रथम पत्र :

प्रथम पत्र : सामान्य ज्ञान, संस्थागत ज्ञान र सेवा सम्बन्धी

वस्तुगत (१०० प्रश्न x १ अङ्क)

खण्ड (क) - (२० अङ्क)

1. **सामान्य ज्ञान** (२० प्रश्न x १ अङ्क)
   - 1.1 विश्वका प्रमुख ऐतिहासिक घटनाहरू
   - 1.2 नेपालको इतिहास
   - 1.3 नेपालको भूगोल
   - 1.4 नेपालको संवैधानिक विकासक्रम र नेपालको संविधान
   - 1.5 नेपालको आर्थिक, राजनीतिक, सामाजिक र सांस्कृतिक व्यवस्था
   - 1.6 आवधिक योजना सम्बन्धी जानकारी
   - 1.7 नेपालका प्रचलित धर्म, संस्कृति, जात जाति, भाषा, साहित्य र कला
   - 1.8 खेलकूद तथा मनोरन्जन सम्बन्धी विविध जानकारी
   - 1.9 विज्ञान र प्रविधि, प्रसिद्ध वैज्ञानिक र तिनको योगदान
   - 1.10 दिगो विकासका लक्ष्यहरू, वातावरण तथा जलवायु परिवर्तन
   - 1.11 अन्तर्राष्ट्रिय संघ संस्था (संयुक्त राष्ट्संघ, इयू, आसियान, बिमष्टेक र सार्क)
   - 1.12 नेपालको वैदेशिक सम्बन्ध र पररा्ष्ट्र नीति
   - 1.13 राष्ट्रिय र अन्तर्राष्ट्रिय महत्वका समसामयिक घट्ना तथा नविनतम गतिविधिहरू

खण्ड (ख) - (२० अङ्क)

2. **संस्थागत ज्ञान र सेवासँग सम्बद्ध कानून** (२० प्रश्न x १ अङ्क)
   - 2.1 प्राविधिक शिक्षा तथा व्यावसायिक तालीमको पृष्ठभूमि, लक्ष्य र उद्देश्य
   - 2.2 राष्ट्रिय शिक्षा नीति, २०७६
   - 2.3 तालीम नीति, २०७१
   - 2.4 प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद् ऐन, २०४५ र नियमावली, २०५१
   - 2.5 प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्, परीक्षा सम्बन्धी विनियमावली, २०७१
   - 2.6 प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्, कर्मचारी सेवा, शर्त तथा सुविधा सम्वन्धी विनियमावली, २०६९
   - 2.7 प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्, आर्थिक प्रशासन सम्वन्धी विनियमावली, २०६२
   - 2.8 स्थानीय सरकार संचालन ऐन, २०७४
   - 2.9 सुशासन (संचालन तथा व्यवस्थापन) ऐन, २०६४
   - 2.10 भ्रष्टाचार निवारण ऐन, २०५९

खण्ड (ग) - (६० अङ्क)

3. **सेवा सम्बन्धी विषय** (६० प्रश्न x १ अङ्क)

   द्वितीय पत्रको सेवा सम्बन्धी विषयको पाठ्यक्रम नै प्रथम पत्रको खण्ड "ग" को सेवा सम्बन्धी विषयको पाठ्यक्रम हुनेछ ।

प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्

पदपूर्ति समिति

सानोठिमी, भक्तपुर ।

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अधिकृतस्तर तृतीय श्रेणी **विद्युत प्रशिक्षक पदको**

खुला र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

द्वितीय पत्र - सेवा सम्बन्धी

खण्ड (क) - (५० % अङ्क)

(४ प्रश्न × ५ अङ्क र ३ प्रश्न ×१० अङ्क)

1. **DC Circuit Analysis**
   - 1.1 Circuit elements: resistor, indicator and capacitor, types of sources
   - 1.2 Series and parallel circuits, voltage and current sources
   - 1.3 Ohm's law, Kirchhoff's laws, bridge circuit, equivalent resistance and star delta transformation
   - 1.4 DC Network Theorem: loop analysis, nodal analysis, Thevenin, Norton, superposition and maximum power transfer theorems
   - 1.5 Transient response analysis of RLC circuit excited by DC source

2. **AC Circuit Analysis**
   - 2.1 Average value and RMS value
   - 2.2 Active, reactive and apparent power, power factor (significance and correction)
   - 2.3 Series and parallel RLC circuit, resonance and quality factor
   - 2.4 Single and three phase system, delta and star connection, Measurement of three phase power
   - 2.5 Transient response analysis of RLC circuit excited by AC source

3. **Electrical Machine**
   - 3.1 Transformer: construction and working principle, ideal and real transformer, EMF equation, equivalent circuit, losses and efficiency, voltage regulation, transformer on load and no-load operation, auto transformer and copper saving, tests on transformer (polarity, no-load and load, back to back, temperature rise test), Three phase transformer, constructional details and connection methods (Δ/Y, Y/Y, Δ/Δ, open delta), power and distribution transformer, transformer in-rush current and harmonics, transformer oil, efficiency curve and all day-efficiency, Importance of parallel operation, conditions of parallel operation of transformers, parallel operation of two single phase transformers, cooling methods of transformer
   - 3.2 DC Machine: constructional details, commutation and armature reaction in DC generators and DC motors, factors affecting commutation, solutions for commutation problems, losses in a DC machine, efficiencies of DC motor and generator, condition of maximum efficiency, power flow diagram of DC machine
     DC Generator: working principle, classification, types and various characteristics of DC generator, EMF equation, Voltage build-up in shunt generator, application of DC generators and selection criteria
     DC Motor: working principle, back emf and mechanical power developed, torque equations of DC motor, shaft torque, Types of DC motor and their various characteristics, necessity of a starter, starting methods of DC motors, three and four point starters, methods of speed control of DC motors, Braking of DC motor and its importance, methods of electric braking of DC motors, application of DC motors and selection criteria, universal motor
   - 3.3 Induction Motors: constructional details and working principle of three- phase induction motor, equivalent circuit, slip and rotor frequency, starting torque, maximum and full load torque, condition for maximum torque, torque-slip characteristics, losses and power flow diagram of induction motor, induction motor as a transformer, efficiency of motor and factors affecting efficiency, no-load test and blocked rotor test, necessity of starter and starting methods (direct

on-line, star-delta starter, autotransformer, slip ring starter), various methods of speed control of induction motors, factors affecting performance of induction motor

Single phase induction motor: working principle, types of single phase induction motor based on starting methods, reluctance start induction motor, applications of single-phase and three-phase induction motors

3.4 Induction Generators: working principle, necessity of capacitor bank, application of induction generators

3.5 Alternators and Synchronous machine: construction and working principle of synchronous generator, EMF equation, effect of harmonics and its elimination, armature reaction in synchronous generator, voltage regulation, power equation and power angle characteristics, capability curve, synchronous generator as source and sink of reactive power, excitation system for synchronous generator (static and brushless), automatic voltage regulator (AVR), effect of varying excitation current, parallel operation of synchronous generator, synchronization procedure and synchroscope, working principle of synchronous motor, hunting and its reduction, application of synchronous motors, reluctance and hysteresis single phase synchronous motors

4. **Transmission and Distribution**

4.1 Choice of working voltage, economic size of line conductors, cost of conductor comparison between overhead and underground system, advantages and limitations of adopting high voltage for transmission, comparison between HVDC and HVAC transmission system

4.2 Main components of overhead lines, single and double circuit, stranded and bundled conductors, conductor materials and conductor spacing, earth wire, sag and tension calculation, clearance above ground, types of insulators, corona and its reduction, skin and proximity effect, Ferranti effect, transposition and its significance, corona and radio interference

4.3 Classification of transmission lines (short, medium and long), ABCD constants, voltage regulation and efficiency, transmission line as source and sink of reactive power, surge impedance loading (SIL), reactive power and voltage control in the receiving end, calculation of shunt capacitor and reactor for VAR compensation, common FACTS devices and their implementation

4.4 Unsymmetrical faults and symmetrical faults, single line to ground fault, line to line fault, double line to ground fault, transient and temporary overvoltages, counter measures to limit the overvoltages

4.5 Distribution system: primary and secondary distribution, classification, feeders and distributors, types of cable faults and its location

4.6 HVDC transmission: HVDC station configuration (filters, converters, Inverters), reversible power flow and control in line, series operation of converters

5. **Switchgear and Protection**

5.1 Faults and sources of faults

5.2 Necessity of protection and basic requirements of protection system

5.3 Fuse and its types, characteristics of HRC fuse

5.4 MCB, MCCB characteristics and working principle

5.5 Isolators and contactors

5.6 Circuit breaker, types of circuit breaker, operating principle and construction of ACB, ABCB, OCB, VCB and SFC circuit breaker, application and selection of circuit breakers, testing of circuit breakers

5.7 Relays and its classification, PMMC, Buchholz relay, over current and earth fault relay, impedance relay and directional relay

5.8 Protection schemes: differential and distance, under voltage, over current and earth fault protection, lightning arrestor, its type and characteristics, tower footing resistance, shielding, grading rings

5.9 Insulation co-ordination, BIL and volt-time characteristics of different equipments
5.10 Earthing: Importance, factors affecting earthing, system and equipment earthing, safe value of current and voltage, step and touch potential, earthing mat, importance of neutral grounding and methods of neutral grounding, resonant grounding

6. **Power Plant**

6.1 Hydro Power Plant: layout and elements of hydro power plants, working principle, classification, merits and demerits, selection of site, mass curve and flow duration curve, hydro turbine: types, classification and selection.
6.2 Microhydro Power Plant (MPH): Role of MHP plant for rural development, governor, electronic and discrete load controllers, automatic voltage controller (AVR), start up and shut down procedure, Measurement of discharge and head at site, load factor, diversity factor and utilization fator, load curve, load duration and energy load curve, tariffs and its types, tariff system in Nepal
6.3 Diesel Power Plant: merits and demerits, components of diesel power plant, application of diesel power plant
6.4 Steam Power Plant: merits and demerits, components of steam power plant and general layout, selection of site for steam power plant
6.5 Solar Power Plant: Solar cell and its types, effect of temperature and insolation on solar cells, tubular and flat plate batteries, factors to be considered while choosing battery for a solar PV system, charge controllers and its types, isolated and grid connected PV system, importance of grid connection, issues to be considered while connecting PV into grid

खण्ड (ख) - (५० % अङ्क)
(४ प्रश्न × ५ अङ्क र ३ प्रश्न ×१० अङ्क)

7. **Measurements and Instruments**

7.1 Classification of measuring instrument, moving iron instruments, moving coil instruments
7.2 Instrument transformers (CT, PT) and their characteristics
7.3 Wattmeters, power factor meters and single phase induction energy meter
7.4 DC/AC potentiometers and their applications
7.5 Megger, construction and working principle
7.6 Measurement of earth resistance and soil resistivity
7.7 Measurement of high ac and impulse voltages

8. **Power Electronics**

8.1 Power semiconductor devices: diode, transistor, thyristor, MOSFET, IGBT
8.2 Rectifiers: Half and full bridge
8.3 DC choppers: classification, switching mode regulators (buck, boost and buck-boost)
8.4 Inverters: single-phase and three-phase inverters, PWM type inverters
8.5 AC voltage controller with resistive load and inductive load, principle and operation of single phase cyclo-converters, step-up and step down cyclo-converters

9. **Control system and Controllers**

9.1 Feedback control system and its advantages, differential equation and transfer function of electrical circuits, speed control of armature DC motor with feedback
9.2 Analogous system (mechanical and electrical) and its importance, signal flow graph and block diagram reduction techniques
9.3 Effect of feedback on steady state gain, bandwidth, time constant, different test signals
9.4 Time response of first and second order system to unit step input, transient response specifications, steady state error, static error constants
9.5 Controllers: proportional, integral, derivative and their applications

9.6 Root location and stability interpretation, effect of addition of poles and zeros on transfer function, R-H criteria and setting loop gain using R-H criteria

9.7 Programmable logic controllers and its working

10. **Utilization of Electrical Energy**

10.1 Load characteristics: load and diversity factor, base and peak load, load curve, load duration curve, power factor, causes of low power factor and its disadvantage, power factor improvement

10.2 Tariffs: types and factors affecting tariffs

10.3 Heating: resistance, induction and dielectric heating

10.4 Illumination: general terms, incandescent and discharge lamps, tungsten and filament lamps, fluorescent tubes, types of lighting schemes, design of lighting schemes and methods of lighting calculations

10.5 Refrigeration and air conditioning: types and working principle

11. **Power System Stability and Load Flow**

11.1 Power flow and power angle curve, swing equation and steady state and transient stability, factors affecting transient stability.

11.2 Equal area criterion and its application, critical clearing angle, two finite machines

11.3 Load flow analysis: Bus admittance matrix, load flow equations and methods of solution, approximate load flow study

11.4 Gauss-Seidel, Newton Raphson and Fast-decoupled methods of load flow

12. **Electrical Installation and Wiring**

12.1 General rules of wiring

12.2 Methods of wiring (Tee and Loop-in system), systems of wiring (cleat wiring, wooden casing and capping wiring, PVC sheathed wiring, conduit wiring), choice of wiring system

12.3 Types of cable for internal wiring, types of insulators main switch, design of main distribution board and sub-distribution board, factors to be considered of installing power circuits

12.4 Determining: number of points, total load, number of sub-circuits, rating of main switch and distribution board, size of conductor, layout of wiring

12.5 Earthing electrode and earthing lead, factors affecting earth resistance, methods of reducing earth resistance, methods of earthing, design of earthing mat

12.6 Fuse units, MCB and ELCB, thermal overload relay for motor protection

13. **ऐन नियमहरु**

१३.१ ईञ्जिनियरिङ्ग परिषद् ऐन, २०५५ र नियमावली, २०५६

१३.२ विद्युत ऐन, २०४९ र नियमावली

१३.३ नेपाल इन्जिनियरिङ्ग परिषद्बाट इञ्जिनियरको लागि चाहिने पेशागत आचरण

१३.४ नेपाल विद्युत प्रशारण तथा वितरण सम्बन्धी नियम
(Voltage, frequency, power factor, voltage level for distribution and transmission)

१३.५ विद्युतीय उपकरण सम्बन्धी सुरक्षाका नियम

- Insulation of electrical line
- Lighting safety, earthing of equipments
- Safety of internal wiring
- इलेक्ट्रिकल डिभाइसहरु मर्मत सम्भार गर्दा अपनाउनु पर्ने सुरक्षा