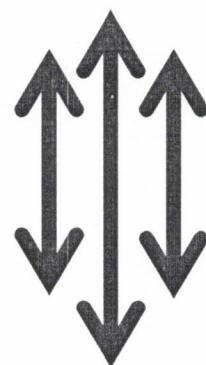


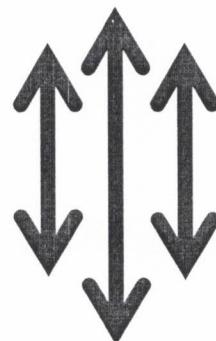
नेपाली सेना

श्री भर्ना छनौट निर्देशनालय, कार्यरथी विभाग,

जंगी अड्डा



प्रा.उ.से. ईलेक्ट्रिकल ईन्जिनियर (खुला) पदको लिखित
परीक्षाको पाठ्यक्रम



२०७७

नेपाली सेना

प्रा.उ.से. ईलेक्ट्रिकल ईन्जिनियर (खुला) पदको लिखित परीक्षाको पाठ्यक्रम

समय: ४ घण्टा

पूर्णाङ्क : १५०

उत्तीर्णाङ्क : ६०

यो पाठ्यक्रम नेपाली सेनाको प्रा.उ.से. ईलेक्ट्रिकल ईन्जिनियर (खुला) पदको उम्मेदवार छनौट परीक्षाको लागि निर्धारण गरिएको हो । लिखित परीक्षामा सरिक हुने उम्मेदवारहरूको पेशा सम्बन्धी विषयलाई आधारमानी प्रश्नहरू सोधिने छ ।

(क) लिखित परीक्षाको माध्यम नेपाली/अंग्रेजी वा दुवै भाषा हुनेछ ।

(ख) लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र अर्को चरणको परीक्षामा सम्मिलित गराईनेछ ।

(ग) प्रश्नपत्र निर्माण गर्दा पाठ्यक्रममा समावेश भएका सबै विषयहरूलाई यथासंभव समिटनेछ ।

(घ) बस्तुगत र विषयगत संयुक्त रूपमा पूर्णाङ्क र उत्तीर्णाङ्क कायम गरिनेछ ।

(ङ) बस्तुगत र विषयगत परीक्षाको पाठ्यक्रम एउटै हुनेछ ।

(च) बस्तुगत र विषयगत विषयको लिखित परीक्षा एकैपटक वा छुट्टाछुट्टै गरी लिन सकिनेछ ।

(छ) यो पाठ्यक्रम मिति २०७७/०८/०८ गतेबाट लागु हुनेछ ।

लिखित परीक्षाको योजना र पाठ्यक्रम

| विषय | पूर्णाङ्क | उत्तीर्णाङ्क | परीक्षा प्रणाली | प्रश्न संख्या अङ्क | समय |
|---------------|-----------|--------------|---------------------|----------------------------|---|
| पेशा सम्बन्धी | ७५ | ६० | बस्तुगत (Objective) | बहु वैकल्पिक प्रश्न (MCQs) | $75 \text{ प्रश्न} \times 1 \text{ अङ्क} = 75$ |
| | ७५ | | विषयगत (Subjective) | छोटो उत्तर लामो उत्तर | $7 \text{ प्रश्न} \times 5 \text{ अङ्क} = 35$ $4 \text{ प्रश्न} \times 10 \text{ अङ्क} = 40$ |

6
10
✓
✓
✓
✓

नेपाली सेना

प्रा.उ.से. इलेक्ट्रिकल इंजिनियर (खूला) पदको लिखित परीक्षाको पाठ्यक्रम

1. BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

- 1.1 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.
- 1.2 DC and 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.
- 1.3 Semiconductor Devices and its applications: Diodes, Transistors, MOSFET,JFET, their types, Biasing and working principle.

2. COMPUTER PROGRAMMING

- 2.1 Introduction to Computers, Problem Solving Using Computer, Introduction to C, Input and Output Statement, Control Statement and Structure of programs, Arrays, Modular Programming and Subprograms, Data file, Data Structures, Structured Programming, Programming Projects and Software Management

3. LOGIC CIRCUIT

- 3.1 The basic gates (NOT, OR, AND), universal logic gates (NOR, NAND), AND - OR- INVERT gates
- 3.2 Boolean Laws and Theorems, Truth Table, SOP and POS method, Karnaugh Simplifications
- 3.3 Multiplexer, DE multiplexers, Decoder, Encoder, Flip Flops, Synchronous machine, synchronous machines, Digital Design example

4. COMMUNICATION SYSTEM

- 4.1 Representation of basic communication system (Analog & Digital), components of communication system, communication channel,
- 4.2 Need for modulation, Amplitude Modulation and Demodulation, Frequency Modulation and demodulation, Phase modulation, Frequency division Multiplexing system.
- 4.3 Super heterodyne receiver in communication system, Representation of random signals and noise in communication system, Noise performance of analog communication systems.

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5. NETWORK ANALYSIS

5.1 Ohms law, Kirchoff's law, nodal and mesh analysis, Series and parallel circuit, delta-star and star-delta transformation, Concept of complex Impedance and Admittance RLC series and parallel circuit

5.2 Network Theorem: Thevenins theorem, Nortons theorem, Superposition theorem, Reciprocity theorem and Maximum power transfer theorem.

5.3 Resonance in series and parallel RLC circuit, Active, Reactive and Apparent power, Transient response of RLC circuit excited by DC and AC sources

5.4 Fourier analysis, Two-port network: Z, Y, T and h parameters, T to Π and Π transformation, two-port network connection, three-phase circuit analysis, phase and line quantities

6. CONTROL SYSTEM

6.1 Mathematical modeling: differential equation representation, transfer function notations and state space representations of physical systems, Block diagram algebra, signal flow graphs

6.2 Transient and steady state response: impulse response, step and ramp response analysis of a 1st and 2nd order systems, overshoot and damping, steady state error and error constants, Effect of feedback on stability and steady state error

6.3 Stability: Relative and absolute stability, Routh -Herwitz criterion

6.4 Root locus: Manual plotting and judging the relative stability using root locus technique

6.5 Frequency response: Polar, and Bode plots, stability in frequency domain, gain margin and phase margins, Nyquist criterion for stability

6.6 Root locus: Manual plotting and judging the relative stability using root locus technique

6.7 Control system design: lead-lag and PID controllers and setting the controller parameters using Root locus and Bode plots

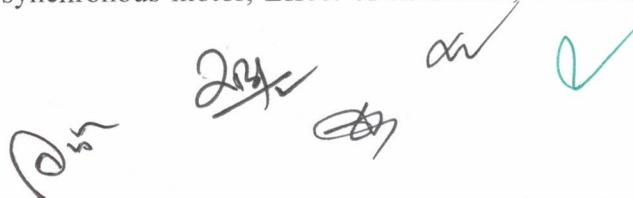
7. STATIC AND DYNAMIC ELECTRICAL MACHINES

7.1 Transformer: Working principle, Equivalent Circuit, Losses and efficiency, Voltage regulation, Transformer tests, Auto transformer, Three phase transformer connections, Parallel operation

7.2 D.C. Machine: Constructional detail, Operation in motoring and generating mode, Back emf in DC motor, Types of DC motor, their characteristics and applications, DC motor starter, Speed control of DC motor

7.3 Induction machine: Equivalent circuit, Torque-speed characteristic, Losses and efficiency, Starting methods, Speed control of three phase induction motor, Induction motor tests, Single phase induction motors- types, characteristics and applications

7.4 Synchronous machine: Salient pole and cylindrical rotor construction, generating and motoring principle, phasor diagram and power angle characteristics, Parallel operation of synchronous generators, Starting methods for synchronous motor, Effect of excitation, V and Inverted V curves, Synchronous condenser



8. ELECTRICAL SUPPLY SYSTEMS

8.1 Power Plants: components of hydro power plant, Steam power Plants and Diesel Power Plants; Turbine classifications, governing systems, Plant use factor; load sharing between base load and peak load plants

8.2 Transmission system: Overhead and underground transmissions, EHV AC and HVDC Transmission

8.3 Electrical and Mechanical design of Over head AC transmission: Selections of conductor size and configuration, supports and cross arms, insulators, sag and tension calculation

8.4 Power Distribution System: primary and secondary distribution, Distribution network layouts, protection coordination in distribution system.

9. POWER SYSTEM ANALYSIS

9.1 Computation of transmission line parameters, GMD and GMR, proximity effect and skin effect

9.2 Transmission line performance: Per unit system representation, Single line diagram, Lumped and distributed parameter modeling, ABCD parameters, efficiency & regulations calculations, Ferranti effect, surge impedance loading

9.3 Load flow: Basic Load flow equation, Gauss-Seidal and Newtan-Rapshon methods

9.4 Over voltages in transmission lines: Power frequency, switching and lightning over voltages, surge arrestors

9.5 VAR compensation: Real and reactive power flow through transmission line, series and shunt compensations

9.6 Fault calculations: Symmetrical and unsymmetrical faults

9.7 Power system stability studies: Steady state & transient stability limits, swing equations, equal area criterion, stability enhancement techniques.

9.8 Corona: corona inception voltage, power loss, waveform deformation, RI and AN due to corona

10. MEASUREMENT AND INSTRUMENTATION

10.1 Accuracy, Precision, Absolute and Relative Errors, Parallax Deflection type measuring instruments: Galvanometer, Ammeter, Voltmeter, Wattmeter, Watt-hour meter, Maximum Demand Meter, Frequency Meter Instrument Transformers:

10.2 Operating Principles of Measuring and Protection type CTs, Potential transformers

10.3 Transducers: Tachometer, potentiometer, Measurement of electrical, mechanical, thermal and hydraulic variables

10.4 Measurement of low medium and high resistances by Ohmmeter method, Meggers and DC bridges, Measurement of inductance, capacitance and frequency by AC bridge circuits

10.5 Operational Amplifier: Signal Amplification, attenuation, differentiation, integration and adder, Operating principles of Analog and Digital Oscilloscope, Analog to Digital and Digital to Analog

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converters

10.6 Digital instrumentation: Fundamental principles, interfacing to the computers, Microprocessor based instrumentation

11. POWER SYSTEM PROTECTION

11.1 Fuse, Magnetic Contactors, Isolators, MCB and MCCB: characteristics and operating principles

11.2 Relays: Electromagnetic and Static Relays, Over current Relay, Impedance Relay, Directional Relay

11.3 Circuit Breakers: ACB, OCB, ABCB, VCB and SF₆ CB; construction, operating principles and applications

11.4 Protection schemes: Over current, under voltage, differential, distance protection

11.5 Grounding: System and equipment grounding, electric shock, safe value of current and voltages, touch and step potentials, Ground Fault Current Interrupters

12. POWER ELECTRONICS

12.1 Devices: Power Transistor, Power Diodes, Thyristor, Triac, MOSFET, UJT, GTO – Construction and their characteristics

12.2 Rectifier: Rectifier using diodes - half wave, full wave, single phase, three phase, capacitor and inductor filters, Controlled rectifier using Thyristors - half wave, full wave, single phase, three phase

12.3 DC chopper: Step down chopper, Step up chopper.

12.4 Inverter: Single phase voltage inverter, three phase voltage inverter, current source inverter

12.5 Cyclo-converter: Single phase and three phase 12.6 AC voltage controller – with resistive load and inductive load

13. ECONOMICS OF POWER UTILIZATION

13.1 Economic considerations: Cost classification; interest and depreciation

13.2 Demand characteristics: load curves, load duration curve, demand factor; load factor, diversity factor, causes of low power factor and its disadvantages, power factor improvement and its economics

13.3 Tariff: objective, factors affecting tariff, types of tariff

13.4 Illumination: Illumination and luminance, radiant efficiency, plane and solid angles, laws of illumination; polar curves, illumination requirement, design of in-door and out-door lighting scheme. Incandescent lamps, arc lamps, sodium discharge lamps, mercury fluorescent lamps, high pressure mercury vapor lamps

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14. SAFETY ENGINEERING:

14.1 Physical effects of electric shock; safety and precaution; safety rules and regulation; safety tools and devices for electricity

14.2 Live line maintenance and precautions; earthing and shielding techniques; fire hazards; fire fighting techniques and equipment; First aid requirements after electrical accidents

15. AC MACHINES

15.1 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

15.2 Synchronous Machines: Working principles; operating characteristics; losses and efficiency; steady state and transient equivalent circuits; excitation system and requirement, parallel operation, hunting.

15.3 Induction Machines: Working principles; operating characteristics of motoring and generating mode; losses and efficiency; equivalent circuit; starters; speed control and motor selection.

16. TRANSMISSION AND DISTRIBUTION

16.1 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

16.2 Corona phenomenon: Factors affecting corona and its disadvantages; radio interference; inductive interference between power and communication lines

16.3 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

16.4 Knowledge of Nepalese power transmission system: voltage levels and length; export-import links for power exchange with India

17. GENERATION OF ELECTRICAL POWER

17.1 Hydroelectric Power Plants: Merits and demerits; site selection; classification; elements of hydroelectric power plant and schematic layouts

17.2 Different types of water turbines; efficiency curves; selection of water turbines

17.3 Essential features of hydroelectric alternators; choice of size and number of generating units; auxiliaries in hydroelectric plant

17.4 Nepalese power plants, their types, salient features and locations

17.5 Diesel Electric Power Plants: Merits and demerits; application; site selection; elements of a diesel

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plant and its schematic arrangement; performance and thermal efficiency

17.6 Non conventional method of power generation: Micro hydro, solar photovoltaic, Solar Design wind and geothermal method of power generation and their importance

17.7 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

17.8 Renewable energy, Sources of Renewable and Non Renewable energy, its advantages and disadvantages

माथि उल्लेखित पाठ्यक्रमका एकाइहरुबाट सोधिने प्रश्नहरुको संख्या निम्नानुसार हुनेछ

| विषय | परिक्षा प्रणाली | | | के |
|-------|---|----------------------------|----------------------------|--------|
| | वस्तुगत (Objective) | | विषयगत (Subjective) | |
| | बहुबैकल्पिक प्रश्न (MCQS) (प्रश्नXअंक) | छोटो उत्तर (प्रश्नXअंक) | लामो उत्तर (प्रश्नXअंक) | |
| 1 | 4x1 | 1x5 | | |
| 2 | 4x1 | | | 1 X 10 |
| 3 | 4x1 | 1x5 | | |
| 4 | 3x1 | | | |
| 5 | 3x1 | 1x5 | | |
| 6 | 4x1 | | | |
| 7 | 4x1 | 1x5 | | 1x10 |
| 8 | 4x1 | | | |
| 9 | 4x1 | | | |
| 10 | 5x1 | 1x5 | | 1x10 |
| 11 | 5x1 | | | |
| 12 | 5x1 | | | |
| 13 | 5x1 | 1x5 | | |
| 14 | 5x1 | | | |
| 15 | 5x1 | 1x5 | | 1x10 |
| 16 | 5x1 | 1x5 | | |
| 17 | 6x1 | | | |
| Total | 75 x 1 = 75 | 7 x 5 = 35 | 4 x 10 = 40 | |

20/2
8/2

✓ ✓

20/2

प्रयोगात्मक परीक्षाको पाठ्यक्रम

समय: ६० मिनेट

पूर्णाङ्क: ५०

उत्तीर्णाङ्क: २५

| S.N. | Topic | Marks | Time (Minutes) |
|------|---|-----------|----------------|
| 1 | Paper simulation | 15 | 15 |
| 2 | Component Identification and it's application | 10 | 10 |
| 3 | Use Of Various Measuring Instrument | 10 | 10 |
| 4 | Fault Finding | 10 | 15 |
| 5 | Viva | 5 | 10 |
| | Total | 50 | 60 min |

समाप्त