

**नेपाल बैंक लिमिटेड**  
**सहायक प्रबन्धक, ६ तह, इलेक्ट्रिकल इन्जिनियर पदको प्रतियोगितात्मक परीक्षाको पाठ्यक्रम**

**पाठ्यक्रमको रूपरेखा :-** यस पाठ्यक्रमको आधारमा निम्नानुसारका चरणमा परीक्षा लिइने छ :

**प्रथम चरण :-** लिखित परीक्षा पूर्णाङ्क :- २००

**द्वितीय चरण :-** अन्तर्वार्ता पूर्णाङ्क :- ३०

**परीक्षा योजना (Examination Scheme)**

**१. प्रथम चरण : लिखित परीक्षा (Written Examination)**

**पूर्णाङ्क :- २००**

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्नसंख्या X अङ्क	समय
प्रथम	Electrical Engineering I	१००	४०	विषयगत	१० प्रश्न X १० अङ्क = १०० अङ्क	३ घण्टा
द्वितीय	Electrical Engineering II	१००	४०	विषयगत	१० प्रश्न X १० अङ्क = १०० अङ्क	३ घण्टा

**२. द्वितीय चरण : अन्तर्वार्ता (Interview)**

**पूर्णाङ्क :- ५०**

विषय	पूर्णाङ्क	परीक्षा प्रणाली
व्यक्तिगत अन्तर्वार्ता	३०	मौखिक

**द्रष्टव्य :**

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी हुनेछ।
- प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ।
- लिखित परीक्षामा यथासम्भव पाठ्यक्रमका सबै एकाईबाट प्रश्नहरू सोधिनेछ।
- विषयगत प्रश्नमा प्रत्येक पत्र/विषयका प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन्। परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डका उत्तरपुस्तिकामा लेख्नुपर्नेछ।
- 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।
- प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ।
- पाठ्यक्रम लागू मिति :-

प्रथम पत्र :- Electrical Engineering I

Section (A): 50 Marks

1. **Basic Electrical 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
2. **Network Analysis**
  - 2.1 Ohms law, Kirchoff's law, nodal and mesh analysis
  - 2.2 Series and parallel circuit, delta-star and star-delta transformation
  - 2.3 Concept of complex Impedance and Admittance
  - 2.4 RLC series and parallel circuit
  - 2.5 Network Theorem: Thevenins theorem, Nortons theorem, Superposition theorem, Reciprocity theorem and Maximum power transfer theorem
  - 2.6 Resonance in series and parallel RLC circuit, bandwidth and effect of Q-factor
  - 2.7 Active, Reactive and Apparent power
  - 2.8 Transient response of RLC circuit excited by DC and AC sources
  - 2.9 Fourier series and Fourier Transform
  - 2.10 Two-port network: Z, Y, T and h parameters, T to  $\Pi$  and  $\Pi$  to T transformation, two-port network connection
  - 2.11 Three-phase circuit analysis, phase and line quantities, three phase power measurement
3. **Electrical Machines**
  - 3.1 **Transformer** : Constructional detail, Operating principle, Equivalent Circuit, Losses and efficiency, Voltage regulation, Exciting current harmonics, Transformer in rush current, Transformer tests, Auto transformer, Three phase transformer connections, Parallel operation
  - 3.2 **D.C. Machine**: Constructional detail, Operating principle of DC generator, Voltage build-up process, Types of DC generator, their characteristics and applications, Losses and efficiency, Armature reaction and commutation, Operating principle of DC motor, Back emf, Types of DC motor, their characteristics and applications, DC motors starter, Speed control of DC motor
  - 3.3 **Induction machine**: Constructional detail, Operating principle of three phase induction motor, Equivalent circuit, Torque-speed characteristic, Losses and efficiency, Starting methods, Speed control of three phase induction motor, Induction motor tests, Induction generator, Single phase induction motors- types, characteristics and applications
  - 3.4 **Synchronous machine**: Constructional detail, Operating principle of synchronous generator, Armature reaction, Equivalent circuit, phasor diagram and power angle characteristics of cylindrical rotor machine and salient pole machine, Parallel operation of synchronous generators, Operating principle of synchronous motor, Starting methods, Effect of excitation on performance of synchronous motor, V and Inverted V curves, synchronous condenser

**Section (B): 50 Marks**

4. **Measurement and Instrumentation**
  - 4.1 Accuracy, Precision, Absolute and Relative Errors, Parallax
  - 4.2 Deflection type measuring instruments: Galvanometer, Ammeter, Voltmeter, Wattmeter, Watt-hour meter, Maximum Demand Meter, Frequency Meter
  - 4.3 Instrument Transformers: Operating Principles of Measuring and Protection type CTs, Potential transformers
  - 4.4 Transducers: Tachometer, potentiometer, Measurement of electrical, mechanical, thermal and hydraulic variables
  - 4.5 Measurement of low medium and high resistances by Ohmmeter method, Meggers and DC bridges
  - 4.6 Measurement of inductance, capacitance and frequency by AC bridge circuits
  - 4.7 Operational Amplifier and filters: Ideal Op-Am, Feedback Op-Am, Adder, Signal Amplification, Attenuation, Differentiation and Integration
  - 4.8 Operating principles of Analog and Digital Oscilloscope
  - 4.9 Analog to Digital and Digital to Analog converters: Weighted resistor type and Ladder type D/A converters, Dual-ramp type and Successive approximation type A/D converters
  - 4.10 Digital instrumentation: Fundamental principles, interfacing to the computers, Microprocessor based instrumentation
5. **Switchgear and Power System Protection**
  - 5.1 Fuse: Types, characteristics and operating principles
  - 5.2 Magnetic Contactors: Types, construction, operating principles
  - 5.3 Isolators (Disconnecting switches): types, construction and operating principles
  - 5.4 MCB and MCCB: Construction, operating principles and characteristics
  - 5.5 Relays: Electromagnetic and Static Relays, Over current Relay, Impedance Relay, Directional Relay
  - 5.6 Circuit Breakers: ACB, OCB, ABCB, VCB and SF<sub>6</sub> CB; construction, operating principles and applications
  - 5.7 Protection schemes: Over current, under voltage, differential, distance protection
  - 5.8 Grounding: System and equipment grounding, electric shock, safe value of current and voltages, touch and step potentials, Ground Fault Current Interrupters
6. **Control System**
  - 6.1 Mathematical modeling: differential equation representation, transfer function notations and state space representations of physical systems,
  - 6.2 Block diagram: block diagram representation of the control system components, signal flow graphs
  - 6.3 Time response: impulse response, step and ramp response analysis of a 1st and 2nd order systems, overshoot and damping concepts
  - 6.4 Steady state error: evaluation of the steady state error and error constants
  - 6.5 Effect of feedback on stability and steady state error
  - 6.6 Stability: Relative and absolute stability, Routh-Herwitz criterion
  - 6.7 Root locus: Manual plotting and judging the relative stability and setting controller parameters of a close loop control system using root locus technique
  - 6.8 Frequency response: Polar and Bode plots, stability in frequency domain, gain margin and phase margins, controller parameters selection using frequency response, Nyquist criterion for stability
  - 6.9 Control system design: lead-lag and PID controllers and setting the controller parameters using Root locus and Bode plots

**द्वितीय पत्र :- Electrical Engineering II**  
**Section (A): 50 Marks**

1. **Hydro Power Policy and Planning**
  - 1.1 History of power development in Nepal; hydro power potential
  - 1.2 Energy supply and demand trends
  - 1.3 Challenges and prospects of hydropower development
  - 1.4 NEA and private sectors in power development
  - 1.5 Concept of deregulation and unbundling
  - 1.6 Concept of independent regulatory commission
  - 1.7 Efforts towards power sector reform
  - 1.8 Salient features of various Nepalese power plants
  - 1.9 Current scenario of transmission and distribution networks and substations in Nepal
  
2. **Generation, Transmission and Distribution**
  - 2.1 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
  - 2.2 Non-Conventional method of power generation: Concept of solar photovoltaic, wind and geothermal method of power generation and their importance
  - 2.3 Transmission system: Overhead and underground transmissions, EHVAC and HVDC Transmission
  - 2.4 Power distribution system: primary and secondary distribution, Distribution network layouts, protection coordination in distribution system
  
3. **Power System Analysis**
  - 3.1 Transmission line parameters: computation of series and shunt parameters of transmission line equivalent circuits, concept of GMD and GMR, proximity effect and skin effect
  - 3.2 Per unit system representation: Single line impedance and reactance diagrams
  - 3.3 Transmission line performance: Lumped and distributed parameter modeling, ABCD parameters, efficiency & regulations calculations, Ferranti effect, surge impedance loading
  - 3.4 Load flow: Basic Load flow equation, Gauss-Seidal and Newton-Raphson methods
  - 3.5 Over voltages in transmission lines: Power frequency, switching and lightning over voltages, surge arrestors
  - 3.6 VAR compensation: Real and reactive power flow through transmission line, series and shunt compensations
  - 3.7 Fault calculations: Symmetrical and unsymmetrical faults
  - 3.8 Stability studies: Steady state & transient stability limits, swing equations, equal area criterion, stability enhancement techniques
  - 3.9 Corona: corona inception voltage, power loss, waveform deformation, RI and AN due to corona

**Section (B): 50 Marks**

**4. Occupational Safety and Health**

- 4.1 Importance occupational safety and health
- 4.2 Physical effects of electric shock; safety and precaution; safety rules and regulation; safety tools and devices for electricity
- 4.3 Live line maintenance and precautions; earthing and shielding techniques; fire hazards; fire fighting techniques and equipment; First aid requirements after electrical accidents

**5. Economics of Power Utilization**

- 5.1 Economic considerations: Cost classification; interest and depreciation
- 5.2 Basic concept about energy audit; Load Management; TOD Meter; Demand Side Management; Power Factor Improvement: Causes and effects of low power factor, advantages and methods of power factor improvement
- 5.3 Plant use factor; load sharing between base load and peak load plants
- 5.4 Tariff: objective, factors affecting tariff, types of tariff
- 5.5 Illumination: Illumination and luminance, radiant efficiency, plane and solid angles, laws of illumination; polar curves, illumination requirement, design of indoor and out-door lighting scheme. Incandescent lamps, arc lamps, sodium discharge lamps, mercury fluorescent lamps, high pressure mercury vapor lamps, CFL and LED lamps

**6. Basic Electronics**

- 6.1 Bi-polar junction transistor: construction, operating characteristics, use as amplifier and switch
- 6.2 Logic circuit: Decimal, Binary and Hexadecimal system, logic gates, adder, Encoder, Decoder, Multiplexer, Demultiplexer
- 6.3 Electronics Devices: Power Transistor, Power Diodes, Thyristor, Triac, MOSFET, UJT, GTO – Construction and their characteristics
- 6.4 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
- 6.5 DC chopper: Step down chopper, Step up chopper
- 6.6 Inverter: Single phase voltage inverter, Three phase voltage inverter, current source inverter
- 6.7 Cyclo-converter – Single phase and three phase
- 6.8 AC voltage controller – with resistive load and inductive load

**7. Constitution, Act and Regulations**

- 7.1 Present Constitution of Nepal
- 7.2 Bank and Financial Institution Act, 2073
- 7.3 Personnel Bylaws of Nepal Bank Limited
- 7.4 Financial Bylaws of Nepal Bank Limited
- 7.5 Public Procurement Act, 2063; and Public Procurement Regulation, 2064
- 7.6 Water Resources Act, 2049 and Water Resources Regulation, 2050
- 7.7 Electricity Act, 2049 and Electricity Regulation, 2050
- 7.8 Environment Protection Act, 2053 and Environment Protection Regulation, 2054