

# नेपाल विद्युत् प्राधिकरण

प्राविधिक सेवा, इलेक्ट्रिकल समूह, इलेक्ट्रोनिक्स उपसमूह, तह-७ ईन्जिनियर पदको  
खुल्ला प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

- शैक्षिक योग्यता: प्रचलित कर्मचारी सेवा विनियमावलीमा व्यवस्था भए अनुसार ।
- लिखित परीक्षाको विषय, पूर्णाङ्क, परीक्षा प्रणाली, प्रश्नसंख्या, अंकभार र समय निम्नानुसार हुनेछ ।

पत्र	विषय	पूर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या	प्रति प्रश्न अंकभार	समय
प्रथम	इलेक्ट्रोनिक्स ईन्जिनियरिङ्ग (I)	३०	वस्तुगत बहु उत्तर	३०	१	३० मिनेट
द्वितीय	इलेक्ट्रोनिक्स ईन्जिनियरिङ्ग (II)	७०	विषयगत	छोटो उत्तर	५	२ घण्टा ३० मिनेट
				लामो उत्तर	३	

- वस्तुगत बहुउत्तर परीक्षा प्रणालीमा प्रत्येक प्रश्नका चार वटा सम्भाव्य उत्तर दिइने छ । जस मध्ये एउटा सही उत्तरमा (✓) चिन्ह लगाउनु पर्नेछ ।
- प्रथमपत्र र द्वितीयपत्रको परीक्षा २ पटक गरेर हुनेछ । प्रथमपत्रको परीक्षा सकिए पछि द्वितीयपत्रको परीक्षा तत्काल हुनेछ ।
- परीक्षाको माध्यम नेपाली वा अंग्रेजी भाषा हुनेछ ।
- वस्तुगत बहुउत्तर परीक्षा प्रणाली भएको विषयमा प्रत्येक प्रश्नको गलत उत्तर वापत २० प्रतिशत अर्थात् ०.२ अंकका दरले त्यस विषयको कुल प्राप्ताङ्कबाट घटाइने छ ।

## प्रथमपत्र र द्वितीयपत्रको पाठ्यक्रम विवरण

### 1. Electric Circuits and Semiconductor devices

*Electric Circuits:* Circuit elements; series and parallel circuits; Kirchoff's laws; Single phase and 3 phase circuits; Power and energy in AC circuits; Transfer functions; Frequency response of networks; Fourier series Transient and Steady state response

*Semiconductor Materials:* Intrinsic & extrinsic semiconductor; impurities, doping, p & n type semiconductor; majority and minority charge carriers, theory of PN junction

*Semiconductor Devices:* Diodes (PN junction diode, zener diode, LED, photo diode, tunnel diode, varactor diode, Schottky diode); Bipolar Transistor (Construction, Operations, Transistor configurations – CE, CB and CC Configurations; small signal model around a dc operating point, Transistor modeling; Different biasing and small signal analysis, BJT Frequency response); Field Effect Transistor (Construction, Characteristics, Types of FET, Basic FET circuits), Switching Circuits (TTL Circuits; MOSFET switch; NMOS Circuits; CMOS Circuits)

### 2. Logic Circuits and Digital Electronics

*Number System:* Decimal, binary, octal, hexadecimal and BCD numbering systems, and their conversions

*Logic Gates:* NOT, OR, AND, NOR, NAND, X-OR, X-NOR gates, laws and theorems of Boolean algebra, K-map

*Combinational Logics:* Half Adder, Full Adder, N-bit adder, Encoder, Decoder, Multiplexer, Demultiplexer, ROM, PLA

*Sequential Logics:* Flip Flops, Shift Registers, Counter, Astable, Monostable and Bistable Multivibrator and Clock

*Digital Electronics:* Bipolar Transistor Switching Characteristics; MOS Transistor Switching Characteristics; Bipolar Transistor Logic Circuits; NMOS Family of Logic Circuits; CMOS Family of Logic Circuits; Memory; Logic Gates

### 3. Electronics Circuits

*Operational Amplifier:* OpAmps characteristics, Basic OpAmp circuits

*Amplifiers:* Class A, Class B, Class AB, Class C and Class D Amplifiers and their circuits; Classifications of Amplifiers on the basis of coupling – RF, Transformer, Direct Coupling Amplifier; Classifications of Amplifiers on the basis of Frequency – Audio, RF and Tuned Amplifiers

*Oscillators:* Feedback concepts, Oscillation theory; Relaxation oscillator; Colpitts, Hartley, Wien bridge, LC, Crystal Oscillators; Voltage Controlled Oscillator

*Voltage Regulators and Power Supplies:* Unregulated and regulated power supplies, voltage regulation, voltage reference, heat and power design, regulator ICs

#### 4. **Communication system**

*Analog Communication:* Modulation, theory and generation of AM, DSB-SC, SSB, FM and PM; comparison between AM, FM and PM; AM, FM and PM transmitters/receivers; superheterodyne receiver; IF & RF amplifiers, automatic gain control (AGC), balanced slope detector, phase discriminator, ratio detector, FM stereo principle, equalizers, noise in analog communication systems

*Digital Communication:* Advantages of digital communication; principle of PAM, PWM, PPM and PCM; OOK, PSK, DPSK, Four Phase PSK, FSK and QAM techniques; noise in digital communication systems

*Optical Fibre Communication:* Advantages of optical transmission, optical spectrum, types of optical fibre cable, attenuation in optical fibre cable, joining of fibres-mechanical coupling and fusion splicing, laser diodes, photodiodes, attenuation measurements, operation and line supervision, optical fibre network in NEA

*Power Line Carrier Communication (PLCC):* Introduction and general theory, transmission channels, frequency range, modulation technique, carrier frequency generation, transmitting amplifier, pilot channel, demodulation, HF filter tuning, line equalization, PLCC system in NEA

*Microwave Communication:* Microwave transmission and reception, microwave triodes, clystrons, magnetrons

#### 5. **Electromagnetic Fields, Transmission Lines and Antennas**

*Electromagnetic Fields:* Electrostatic Fields in Free Space; Gauss's Law in Integral Form and Application (Conductors, insulators and semiconductors); Wave Equations (Polarization, wave impedance, skin effect, Reflection and refraction at the interface between two media, Standing wave ratio, Impedance matching, Quarter wave transformer)

*Transmission Lines:* Basic principles, fundamentals of transmission lines, characteristics impedance, Types of Transmission Lines (Coaxial cable, Open wire, Wave guide), Equivalent diagram of T.L., Matched and Mismatched T.L., losses in transmission lines, standing waves, Power and signal transmission capability of lines

*Waveguides and Resonators:* Theory and operation of waveguide, parallel plane, rectangular, circular, ridged and flexible waveguides; waveguide coupling, matching and attenuation; theory and operation of resonator

*Antennas:* Types, antenna gain, antenna resistance, bandwidth, beamwidth, polarization, directivity, effect of antenna height, dipole, dipole arrays, folded dipole; yagi, parabolic, horn, helical, discone and loop antennas, Propagation in the radio frequency spectrum

#### 6. **Microprocessor and Microcomputer**

*Microprocessor:* Registers, memory, and input/output, fundamental bus signals

*Assembly Language Programming:* Assembler syntax, macro assemblers, cross assembler

*Internal Architecture of Basic Microprocessor:* Internal resources of microprocessor – registers, data paths, control units and arithmetic and logic units, relation between RTL and assembly language

*Interrupt Operations:* Interrupt behavior, interrupt service routine requirements, interrupt priority, vectored, chained and polled interrupt structures, peripheral devices using interrupts

*Microcomputer:* Building blocks of a microcomputer, RISC and CISC computers, Operating systems, Software system concepts, Data communications concepts

**7. Instrumentation and Control**

*Applied Electronics:* Voltage Summing, Voltage buffer; Switched Mode Power Supply; Inverters; Choppers; Diode, Thyristors, Triac, Controlled Rectifier Circuits; Darlington Pair, Wave Shaping Circuits; Active filters; Phase Lock Loops

*Instrumentation:* Instrumentation Systems; Theory of Measurements (Static performance – accuracy, precision, sensitivity, resolution and linearity; Dynamic Performance – response time, frequency response, bandwidth and errors in the measurements)

*Measurement Transducers:* Temperature, light level, strain and displacement, acceleration, pressure, force, velocity, magnetic field measurement

*Digital to Analog Conversions:* A/D and D/A conversions

*Output Devices:* Indicators, meters, strip chart recorder, magnetic tape recorders

*Component Modeling and Linearization:* Differential equations and transfer functions, state space formulation, fluid, fluidic and thermal system components, linearized approximation of non-linear characteristics

*System Transfer Functions and Responses:* Combinations of components to physical systems, system reductions, laplace transform, steady state equilibrium system,

*Stability:* characteristic equation, complex plane interpretation of stability, root locations and stability, Root Locus Method; Frequency Response Method; Performance Specifications for Control System

**8. Engineering Economics and Financial Analysis**

*Essential Business and Accounting Terminology:* Cost Classification and Analysis; Interest and Time Value of Money; Demand Analysis and Sales Forecasting Tariff Structure; Methods of Economic/Financial Analysis; Investment Decision; Interest and Time value of Money

*Basic Methodology of Engineering Economics Studies:* Cost Benefit Analysis, Risk Analysis, Investment Decision, Internal Rate of Return, Net Present Worth, Payback Period

**9. Electronic Construction and Safety Engineering**

*Prototyping methods:* Breadboards, PC prototyping boards

*Printed Circuits:* PC board fabrication, PC board designs, CAD/CAM

*Safety and Precautions:* Safety Rules and Regulations; Storage and handling of Explosives, Compressed Gases and Flammable Substances; Safety and Precautions in case of Hazards

*Earthing and Shielding Techniques:* Fire Hazards, Fire Fighting Techniques and Equipment

*Noise Hazards:* Sources of Noise, Control of Noise and its Effect on Health, First Aid Requirements for after the event treatment

**10. Institutional Know-How**

- (a) General knowledge of Nepal Electricity Authority, its organizational structure and function of various business groups.
- (b) General knowledge of various power plants of Nepal, their types, salient features and their geographical locations.
- (c) General knowledge on Nepalese Power Transmission System, Voltage levels and Lengths, export-import links for Power exchange with India.

