

लोक सेवा आयोग
नेपाल इन्जिनियरिङ्ग सेवा, इलेक्ट्रिकल इन्जिनियरिङ्ग समूह, जनरल इलेक्ट्रिकल इन्जिनियरिङ्ग उपसमूह राजपत्राङ्कित तृतीय श्रेणी,
इलेक्ट्रिकल इन्जिनियर पदको खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

यस पाठ्यक्रम योजनालाई दुई चरणमा विभाजन गरिएको छ :

प्रथम चरण :-	लिखित परीक्षा (Written Examination)	पूर्णाङ्क :- २००
द्वितीय चरण :-	(क) सामूहिक परीक्षण (Group Test)	पूर्णाङ्क :- १०
	(ख) अन्तर्वार्ता (Interview)	पूर्णाङ्क :- ३०

परीक्षा योजना (Examination Scheme)

प्रथम चरण : लिखित परीक्षा (Written Examination)

पूर्णाङ्क :- २००

पत्र	विषय	खण्ड	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्नसंख्या × अङ्क	समय
प्रथम	General Subject	Part I: General Awareness & General Reasoning Test	१००	४०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs)	५० प्रश्न × १ अङ्क	१ घण्टा ३० मिनेट
		Part II: General Technical Subject					५० प्रश्न × १ अङ्क	
द्वितीय	Technical Subject		१००	४०	विषयगत (Subjective)	छोटो उत्तर लामो उत्तर	४ प्रश्न × ५ अङ्क ८ प्रश्न × १० अङ्क	३ घण्टा

द्वितीय चरण : सामूहिक परीक्षण (Group Test) र अन्तर्वार्ता (Interview)

पूर्णाङ्क :- ४०

पत्र / विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	समय
सामूहिक परीक्षण (Group Test)	१०		सामूहिक छलफल (Group Discussion)	३० मिनेट
अन्तर्वार्ता (Interview)	३०		बोर्ड अन्तर्वार्ता (Board Interview)	-

द्रष्टव्य :

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
- प्रथमपत्र र द्वितीयपत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको 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 ।
- बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
- विषयगत प्रश्नहरूको हकमा तोकिएको अंकको एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिने छ ।
- द्वितीय पत्रमा (विषयगत प्रश्न हुनेका हकमा) प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको 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 ।
- यस भन्दा अगाडि लागू भएका माथि उल्लेखित सेवा, समूहको पाठ्यक्रम खारेज गरिएको छ ।
- पाठ्यक्रम लागू मिति : - २०८०/०७/२०

प्रथम पत्र (Paper I): General Subject

Part (I) : - General Awareness & General Ability Test (50 Marks)

1. **General Awareness and Contemporary Issues** (25 ×1 Mark = 25 Marks)
 - 1.1 Physical, socio-cultural and economic geography and demography of Nepal
 - 1.2 Major natural resources of Nepal
 - 1.3 Geographical diversity, climatic conditions, and livelihood & lifestyle of people
 - 1.4 Notable events and personalities, social, cultural and economic conditions in modern history of Nepal
 - 1.5 Current periodical plan of Nepal
 - 1.6 Information on sustainable development, environment, pollution, climate change, biodiversity, science and technology
 - 1.7 Nepal's international affairs and general information on the UNO, SAARC & BIMSTEC
 - 1.8 The Constitution of Nepal (From Part 1 to 5 and Schedules)
 - 1.9 Governance system and Government (Federal, Provincial and Local)
 - 1.10 Provisions of civil service act and regulation relating to constitution of civil service, organisational structure, posts of service, fulfillment of vacancy and code of conduct
 - 1.11 Functional scope of public services
 - 1.12 Public Service Charter
 - 1.13 Concept, objective and importance of public policy
 - 1.14 Fundamentals of management : planning, organizing, directing, controlling, coordinating, decision making, motivation and leadership
 - 1.15 Government planning, budgeting and accounting system
 - 1.16 Major events and current affairs of national and international importance
2. **General Reasoning Test** (25 ×1 Mark = 25 Marks)
 - 2.1 **Logical Reasoning** (9×1 Mark = 9 Marks)

Verbal Ability, Alphanumeric Series, Reasoning Analogies, Classification, Coding-Decoding, Order & Ranking, Distance & Directions, Analytical and Logical Reasoning, Assertion and Reason, Statement and Conclusion, Input-Output, Venn- diagram
 - 2.2 **Numerical Reasoning** (8×1 Mark = 8 Marks)

Arithmetic Series, Analogy, Classification, Arithmetical Reasoning, Fraction. Percentage, Ratio, Average, Profit & Loss, Time & Work, Date & Calender, Data Sufficiency, Data Interpretation & Data Verification
 - 2.3 **Spatial Reasoning** (8×1 Mark = 8 Marks)

Figure Series, Figure Analogy, Figure Classification, Figure Matrix, Pattern Completion, Embedded Images, Image Formation & Analysis, Mirror and Water Images, Cubes and Dices, Paper Folding & Cutting

Part (II) : - General Technical Subject (50 Marks)

- 1. D.C. CIRCUIT ANALYSIS (10%)**
 - 1.1 Circuit elements: Resistor, Inductor and Capacitor
 - 1.2 Dependent and independent current source and voltage source
 - 1.3 Ohms law, Kirchoff's law, nodal and mesh analysis
 - 1.4 Series and parallel circuit, delta-star and star-delta transformation
 - 1.5 Network Theorem: Thevenins theorem, Nortons theorem, Superposition theorem, Reciprocity theorem and Maximum power transfer theorem.
 - 1.6 Transient response of RLC circuit excited by DC source
- 2. A.C. CIRCUIT ANALYSIS (10%)**
 - 2.1 Alternating voltage and current, average and RMS value.
 - 2.2 RLC series and parallel circuits, Phasor algebra
 - 2.3 Concept of complex Impedance and Admittance
 - 2.4 Resonance in series and parallel RLC circuit, bandwidth and effect of Q-factor
 - 2.5 Active, Reactive and Apparent power
 - 2.6 Transient response of RLC circuit excited by AC source
 - 2.7 Fourier series and Fourier Transform
 - 2.8 Two-port network: Z, Y, T and h parameters, T to Π and Π to T transformation, two-port network connection
 - 2.9 Generation of three-phase voltages, star and delta connections, current and voltage relation in star and delta connections, three phase power measurement
- 3. ELECTRICAL MACHINES (10%)**
 - 3.1 Transformer : Constructional detail, Operating principle, Equivalent Circuit, Losses and efficiency, Voltage regulation, Exciting current harmonics, Transformer inrush 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.
- 4. INSTRUMENTATION (10%)**
 - 4.1 Transducers: Measurement of electrical, mechanical, thermal and hydraulic variables

- 4.2 Moving Coil and Moving Iron Instruments: Galvanometer, Ammeter, Voltmeter, Wattmeter, Watt-hour meter, Maximum Demand Meter, Frequency Meter and Power Factor Meter
 - 4.3 Accuracy and Precision: Parallax, Absolute and Relative Errors
 - 4.4 Measurement of low, medium, high resistances and Megger
 - 4.5 DC and AC bridge circuits
 - 4.6 Operational Amplifier and filters: Ideal Op-Am, Feedback Op-Am, Adder, Signal Amplification, attenuation, differentiation and integration
 - 4.7 Oscilloscope: Operating principles, Analog and Digital Oscilloscope
 - 4.8 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
 - 4.9 Digital instrumentation: Fundamental principles, interfacing to the computers, Microprocessor based instrumentation
 - 4.10 Instrument Transformers: Construction and Operating Principles of Measuring and Protection type CTs, Potential transformers
- 5. GENERATION, TRANSMISSION AND DISTRIBUTION (10%)**
- 5.1 Hydroelectric Power Plants: Hydraulic to electrical energy conversion, output power equation, classification, elements of hydroelectric power plant and schematic layouts, site selection, classification of water turbines, working principle of different types of water turbines, physical characteristics and efficiencies, governing of water turbines, selection of water turbines, essential features of hydroelectric alternators, auxiliaries in hydroelectric plant, advantages and disadvantages of hydroelectric plants.
 - 5.2 Steam power Plants: Elements of a steam power plant and their schematic arrangement; working principle, vibration monitoring, governing, cooling efficiency, alternators used for steam turbine driven units
 - 5.3 Diesel Power Plants: Elements of a diesel power plant, schematic arrangement; working principle, efficiency, cooling, governing, speed control, application, performance and thermal efficiency, alternators used for diesel units, advantages and disadvantages of diesel plants.
 - 5.4 Non-Conventional method of power generation: Concept of solar photovoltaic, wind and geothermal method of power generation and their importance
 - 5.5 Power transmission system: Overhead and underground transmissions, advantages and limitations of high voltage transmission; choice of working voltage, conductor size and configuration, supports and cross arms, insulators used in overhead lines, vibration dampers sag tension calculation.
 - 5.6 Power Distribution System: Voltage levels, primary and secondary distribution, radial and ring mains distribution, single phase and three phase ac distribution, pole/tower types, conductors and insulators used in distribution lines, distribution transformer and its accessories, protection coordination in distribution system.
- 6. POWER SYSTEM ANALYSIS (10%)**
- 6.1 Transmission line parameters: Computation of series and shunt parameters of transmission line equivalent circuits, concept of GMD and GMR, proximity effect and skin effect.
 - 6.2 Per unit system representation: Single line impedance and reactance diagrams

- 6.3 Transmission line performance: Lumped and distributed parameter modeling, ABCD parameters, efficiency & regulations calculations, Ferranti effect, surge impedance loading
- 6.4 Load flow: Y-bus of a power system network, Gauss-Seidal and Newton-Raphson methods
- 6.5 Over voltages in transmission lines: Power frequency, switching and lightning over voltages, surge arrestors
- 6.6 VAR compensation: Real and reactive power flow through transmission line, series and shunt compensations
- 6.7 Fault calculations: Symmetrical components, grounded & ungrounded systems, L-G, L-L, L-L-G and 3-phase faults.
- 6.8 Stability studies: Steady state & transient stability limits, swing equations, equal area criterion, stability enhancement techniques.
- 6.9 Corona: corona inception voltage, power loss, waveform deformation, RI and AN due to corona

7. SWITCHGEAR AND PROTECTION (10%)

- 7.1 Fuse: Types, characteristics and operating principles
- 7.2 Magnetic Contactors: Types, construction, operating principles
- 7.3 Isolators (Disconnecting switches): types, construction and operating principles
- 7.4 MCB and MCCB: Construction, operating principles, characteristics
- 7.5 Relays: Electromagnetic and Static Relays, Over current Relay, Impedance Relay, Directional Relay
- 7.6 Circuit Breakers: ACB, OCB, ABCB, VCB and SF6 CB; construction, operating principles and applications
- 7.7 Protection schemes: Over current, under voltage, differential, distance protection
- 7.8 Grounding: System and equipment grounding, electric shock, safe value of current and voltages, touch and step potentials, Ground Fault Current Interrupters

8. AUTOMATIC CONTROL SYSTEM (10%)

- 8.1 Mathematical modeling: differential equation representation, transfer function notations and state space representations of a physical systems.
- 8.2 Block diagram: block diagram representation of the control system components, signal flow graphs.
- 8.3 Time response: impulse response, step and ramp response analysis of a 1st and 2nd order systems, overshoot and damping concepts.
- 8.4 Steady state error: evaluation of the steady state error and error constants
- 8.5 Stability: Relative and absolute stability, Routh-Herwitz criterion.
- 8.6 Controllers: lead-lag and PID controllers.
- 8.7 Root locus: judging the relative stability and setting controller parameters of a close loop control system using root locus technique.
- 8.8 Frequency response: Polar and Bode plots, stability in frequency domain, gain margin and phase margins, controller parameters selection using frequency response.

9. BASIC ELECTRONICS (10%)

- 9.1 Bi-polar junction transistor: construction, operating characteristics, use as amplifier and switch.

- 9.2 Logic circuit: Decimal, Binary and Hexadecimal system, logic gates, adder, Encoder, Decoder, Multiplexer, Demultiplexer.
- 9.3 Power Electronics Devices: Thyristor, Triac, MOSFET, UJT, GTO – Construction and their characteristics
- 9.4 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.
- 9.5 DC chopper: Step down chopper, Step up chopper.
- 9.6 Inverter: Single phase voltage inverter, Three phase voltage inverter, current source inverter.
- 9.7 Cyclo-converter – Single phase and three phase.
- 9.8 AC voltage controller – with resistive load and inductive load.

10. UTILIZATION OF ELECTRICAL ENERGY (10%)

- 10.1 Economic considerations: Cost classification; interest and depreciation
- 10.2 Load 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
- 10.3 Plant use factor; load sharing between base load and peak load plants
- 10.4 Tariff: objective, factors affecting tariff, types of tariff
- 10.5 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.
- 10.6 Lamps: Incandescent lamps, arc lamps, sodium discharge lamps, mercury fluorescent lamps, high pressure mercury vapor lamps
- 10.7 Electrical energy conservation and analysis.