

राष्ट्रिय प्रसारण ग्रिड कम्पनी लिमिटेड

इन्जिनियरिङ्ग सेवा, इलेक्ट्रिकल समूह, ७ तह, इन्जिनियर पदको खुला र आन्तरिक प्रतियोगितात्मक परीक्षाको

पाठ्यक्रम

पाठ्यक्रम योजनालाई निम्नानुसारका दुई चरणमा विभाजन गरिएको छः

प्रथम चरण:- लिखित परीक्षा

पूर्णाङ्क:- २००

द्वितीय चरण:- अन्तरवार्ता

पूर्णाङ्क:- ३०

परीक्षा योजना (Examination Scheme)

१. प्रथम चरण:- लिखित परीक्षा

पूर्णाङ्क:- २००

पत्र	विषय	पूर्णाङ्क	उतीर्णाङ्क	परीक्षा प्रणाली		प्रश्नसंख्या × अङ्क	समय
प्रथम	संस्थागत र व्यवस्थापकीय ज्ञान	१००	४०	वस्तुगत	बहुवैकल्पिक प्रश्न (MCQ)	५० प्रश्न × २अङ्क	४५ मिनेट
द्वितीय	तथा सेवा सम्बन्धी (प्राविधिक)	१००	४०	विषयगत	छोटो उत्तर लामो उत्तर	६ प्रश्न × ५अङ्क ७ प्रश्न × १०अङ्क	३ घण्टा

२. द्वितीय चरण:- अन्तरवार्ता

पूर्णाङ्क:- ३०

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तरवार्ता	३०	मौखिक

द्रष्टव्यः

- यो पाठ्यक्रमको योजनालाई प्रथम चरण र द्वितीय चरण गरी दुई भागमा विभाजन गरिएको छ।
- प्रथम र द्वितीय पत्रको विषयवस्तु एउटै हुनेछ।
- प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ।
- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ।
- 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।
- वस्तुगत बहुवैकल्पिक हुने परीक्षामा परीक्षार्थीले उत्तर लेखदा 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।
- बहुवैकल्पिक प्रश्न हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन।
- परीक्षामा सोधिने प्रश्नसंख्या, अङ्क र अङ्कभार सामान्यतया सम्बन्धित पत्र/विषयमा दिइए अनुसार हुनेछ।
- विषयगत प्रश्न हुने पत्रका हकमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन्। परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्ने छ।
- 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 स्वीकृत मिति:- २०७८/११/१७

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पाठ्यक्रम

प्रथम र द्वितीय पत्र:- संस्थागत र व्यवस्थापकीय ज्ञान र सेवा सम्बन्धी (प्राविधिक)

भाग (अ)- सेवा सम्बन्धी (प्राविधिक)

खण्ड (क)- (४०% अङ्क)

1. Electrical Engineering Basics and Network Analysis

- 1.1 Electric charge and current, direct and alternating currents, electric voltage, potential difference, power and energy
- 1.2 Ohm's Law, Kirchoff's Law; Star/ Delta and Delta/Star transformation;
- 1.3 Network theorems; superposition theorem, maximum power transfer theorem, Thevenin's theorem and Norton's theorem
- 1.4 Inductance and Capacitance in AC circuits; voltage and currents in circuit elements, equivalent inductance and capacitance computations.
- 1.5 AC system analysis: concept of phase difference, active and reactive power, complex power, power triangle, power factor, resonance in AC circuits
- 1.6 Three phase systems; balanced and unbalanced systems, voltage current relations and computation of power in three phase systems.
- 1.7 Laplace Transform in Circuit Analysis; Circuit Analysis in the S-Domain
- 1.8 Transfer Function, Partial Fraction Expansions, the Convolution Integral
- 1.9 Transients in electrical circuits; natural and step response of RL and RC and RLC Circuits
- 1.10 Operational Amplifiers; Operational Amplifier concepts, Inverting and Non-inverting Amplifier Circuits, The Difference Amplifier, zero crossing detectors
- 1.11 Two port networks, reciprocity theorems

2. Electrical Machines

- 2.1 Magnetic circuits: Flux and 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.
- 2.2 Transformer: Constructional detail, Operating principle, Equivalent Circuit, Losses and efficiency, Voltage regulation, Exciting current harmonics, Transformer inrush current, Transformer tests, Auto transformer connections, Three phase transformer connections, Parallel operation.
- 2.3 DC 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
- 2.4 Induction machine: Constructional detail, Operating principle of three phase induction motor, Equivalent circuit, Torque-speed characteristics, Losses and efficiency, Starting methods, Speed control of three phase induction motor types, characteristics and applications
- 2.5 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 motors, V and Inverted V curves.

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3. Measurements, Instrumentation and Control

- 3.1 Accuracy, Precision, Absolute and Relative Errors, Parallax
- 3.2 Moving coil and Moving Iron Instruments: Galvanometer, Ammeter, Voltmeter, Wattmeter, Watt-hour meter, Maximum Demand meter, Frequency meter and Power Factor meter
- 3.3 Instrument Transformers: Operating Principles of Measuring and Protection type CTs, Potential transformers
- 3.4 Transducers: Tachometer, Potentiometer, Measurement of electrical, mechanical, thermal and hydraulic variables
- 3.5 Measurement of low medium and high resistances by Ohmmeter method, Mergers and DC bridges
- 3.6 Measurement of inductance, capacitance and frequency by AC bridge circuits
- 3.7 Operational Amplifier: Signal Amplification, attenuation, differentiation, integration
- 3.8 PID Controller; controlling the transient response and steady state error

4. Generation and Distribution

- 4.1 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
- 4.2 Non- conventional method of power generation: Concept of solar photovoltaic, wind and geothermal method of power generation and their importance
- 4.3 Power Distribution System: Voltage levels, primary and secondary distribution, radial and ring mains distribution, single phase and three phase ac distribution, Distribution network layouts, protection coordination in distribution system
- 4.4 Distribution System materials: conductors, insulators, pole and tower structure, surge arrestor, distribution transformer and its accessories

5. Power Electronics

- 5.1 Power electronics devices; Diode, power transistors, MOSFET, thyristors, GTO, IGBT
- 5.2 Rectifiers; uncontrolled and controlled rectifiers, operation with inductive loads, harmonic filtering, half wave and full wave rectifier circuits and the output waveforms
- 5.3 Inverters: basic details and operation of inverters; voltage source and current source inverters, harmonic filtering
- 5.4 DC choppers; cyclo-converters; AC voltage controllers

खण्ड (ख)- (४०% अङ्क)

6. Power System Studies

- 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 performances: Per unit system representation, Single line diagram, Lumped and distributed parameter modelling, ABCD parameters, efficiency & regulations calculations, Ferranti effect, surge impedance loading
- 6.4 Load flow studies: Bus classification, load flow methods
- 6.5 Fault calculations: significance of fault analysis, symmetrical and unsymmetrical faults; symmetrical components; sequence impedances; short circuit current calculations
- 6.6 Power system stability studies: Steady state, transient and dynamic stability; Steady state & transient stability limits; swing equation; equal area criterion; critical clearing angle; factors affecting transient stability, transient stability enhancements techniques

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7. Power System Transmission

- 7.1 Transmission Lines: Overhead and Underground Transmission Lines; HV, EHV and UHV Transmission Line; HVDC Transmission Line
- 7.2 VAR compensation: Real and reactive power flow control in transmission line, series and shunt compensations, power frequency control
- 7.3 Over voltages in transmission lines: Power frequency, switching and lightning over voltages, surge arrestors, insulation coordination
- 7.4 Corona: corona inception voltage, power loss, waveform deformation, RI and AN due to corona
- 7.5 Electrical and Mechanical design for Overhead AC transmission, Selection of conductor size and configuration, supports and cross arms, insulators, sag and tension calculation
- 7.6 Transmission Line Component: Conductors, Insulators, OPGW, Supporting Structure, Tower Earthing Materials, and Fitting Materials

8. Switchgear and Protection

- 8.1 Types of protective relays; working principle and application, electromagnetic, static and digital relays
- 8.2 Protection of generators, transformers and transmission and distribution lines;
- 8.3 Circuit Breakers: Construction and operating principles of Air Circuit Breaker (ACB), Oil Circuit Breaker (OCB), Vacuum Circuit Breaker (VCB) and SF₆ circuit breakers, and their applications;
- 8.4 Over voltage computations, Protection against switching over voltage and lightning, surge arrestors and their applications.
- 8.5 Substations; classification; indoor and outdoor substations; GIS and AIS substations; selection and location of site; bus bar arrangements; substation earthing
- 8.6 Protection schemes: Over Current, under voltage, differential, distance protection
- 8.7 Grounding: System and equipment grounding, electric shock, safe value of current and voltages, touch and step potentials, Ground Fault Current Interrupters
- 8.8 Swing curve and swing equation, equal area criterion
- 8.9 Economic operation of power system and auto economic load dispatch

9. Utilization and Trade

- 9.1 Illumination and Lighting: Illumination principles in Industrial and domestic lighting, Types of Lamps
- 9.2 Economic considerations: Cost classification; interest and depreciation
- 9.3 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
- 9.4 Tariff: objective, factors affecting tariff, type of tariff
- 9.5 Electrical Vehicles, Battery and its technologies, Green Hydrogen

10. Service Specific

- 10.1 Nepal Electricity Grid Code, 2080
- 10.2 Transmission System Master Plan, 2075
- 10.3 Concept of Energy banking, Electricity Trading (Domestic and Cross Border),
- 10.4 Transmission Open Access, Transmission wheeling charge
- 10.5 Power sector reform: power sector unbundling, power pool, transmission system operator, independent system operator,

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भाग (आ)- संस्थागत र व्यवस्थापकीय ज्ञान

खण्ड (ग)- (२०% अङ्क)

1. Institutional Knowledge and Related Legislations

- 1.1 Rastriya Prasaran Grid Company Limited (RPGCL): Introduction, mission, vision, organisational structure, functions, present status, opportunities, challenges and possibilities
- 1.2 Corporate Development Plan (CDP) of RPGCL
- 1.3 The RPGCL Memorandum of Association and Article of association, 2072
- 1.4 The RPGCL Rules and bylaws
- 1.5 Constitution of Nepal, 2072 (part 1 to 5 and annexes)
- 1.6 Related Acts, Rules and Policies
 - 1.6.1 Hydropower development policy, 2057
 - 1.6.2 Electricity Act, 2049 and Electricity Regulation, 2050
 - 1.6.3 Environment Protection Act, 2076 (Preamble, Chapter 1,2,4,6,7)
 - 1.6.4 Environment Protection Regulation, 2077 (Preamble, Chapter 1,2,4,6,7,8; Annex-1, 2,3)
 - 1.6.5 Forest Act, 2076 (Preamble, Chapter 2,3,12,13,14)
 - 1.6.6 Forest Regulation, 2079 (Preamble, Chapter 12; Annexes-9,50,51,52)
 - 1.6.7 Procurement Act, 2063 and Procurement Regulation, 2064

2. Management and Professional Practice

- 2.1 Management: Concept, Function and Scope
- 2.2 Motivation, Leadership, Coordination, Team work, Decision Making
- 2.3 Organizational Behaviour and Grievance Handling
- 2.4 Corporate planning and strategic management
- 2.5 Ethics and Professionalism: Perspective on morals, codes of ethics and guidelines of professional practice
- 2.6 Public procurement practices for works, goods and services and its importance; relationship among client, consultant and contractor

3. Occupational Safety

- 3.1 Effects of electric shock on human beings, first aid requirements, safety and precautions against electric shocks; safety rules and regulation;
- 3.2 Safety rules and regulation in the project construction area, safety tools and devices, live line maintenance system,
- 3.3 Storage and handling of explosives, hazard mitigation
- 3.4 Fire hazards; Types of fire and firefighting techniques

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प्रथम पत्रको लागि सामान्यतया निम्नानुसार प्रश्नहरू सोधिने छ।

प्रथम पत्र (वस्तुगत)					
भाग	विषय	खण्ड	परीक्षा प्रणाली	अङ्कभार	प्रश्न संख्या
(अ)	सेवा सम्बन्धी	(क)	बहुवैकल्पिक प्रश्न (MCQS)	४०	२० प्रश्न × २अङ्क = ४०
		(ख)		४०	२० प्रश्न × २अङ्क = ४०
(आ)	संस्थागत र व्यवस्थापकीय ज्ञान	(ग)		२०	१० प्रश्न × २अङ्क = २०

द्वितीय पत्रको लागि सामान्यतया निम्नानुसार प्रश्नहरू सोधिने छ।

द्वितीय पत्र (विषयगत)					
भाग	विषय	खण्ड	अङ्कभार	छोटो उत्तर	लामो उत्तर
(अ)	सेवा सम्बन्धी	(क)	४०	२ प्रश्न × ५अङ्क = १०	३ प्रश्न × १०अङ्क = ३०
		(ख)	४०	२ प्रश्न × ५अङ्क = १०	३ प्रश्न × १०अङ्क = ३०
(आ)	संस्थागत र व्यवस्थापकीय ज्ञान	(ग)	२०	२ प्रश्न × ५अङ्क = १०	१प्रश्न × १०अङ्क = १०