

## नेपाल आयल निगम लिमिटेड

खुला तथा आन्तरिक प्रतियोगितात्मक परीक्षाको लागि पाठ्यक्रम एवं परीक्षा योजना

स्तर : अधिकृत, सेवा : प्राविधिक, समूह : इन्जिनियरिङ्ग, तह : ८, पद : प्रबन्धक (इलेक्ट्रिकल)

यस पाठ्यक्रम योजनालाई दुई चरणमा विभाजन गरिएको छ :

प्रथम चरण :- लिखित परीक्षा, पूर्णाङ्क : २००

द्वितीय चरण :- अन्तर्वार्ता, पूर्णाङ्क : ३०

### प्रथम चरण - लिखित परीक्षा

पत्र	विषय	परीक्षा प्रणाली	प्रश्न संख्या	अंक भार	समय	पूर्णाङ्क	उत्तीर्णाङ्क
प्रथम	शासकीय व्यवस्था र विकास	विषयगत	५	५ प्रश्न × १५ = ७५ अंक	३ घण्टा	१००	४०
		समस्या समाधान (विषयगत)	१	१ प्रश्न × २५ = २५ अंक			
द्वितीय	सेवा सम्बन्धी	विषयगत	५	५ प्रश्न × १५ = ७५ अंक	३ घण्टा	१००	४०
		समस्या समाधान (विषयगत)	१	१ प्रश्न × २५ = २५ अंक			

### द्वितीय चरण - अन्तर्वार्ता

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	३०	मौखिक

### द्रष्टव्य :

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
- प्रथम पत्र र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- प्रत्येक पत्रको लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परिक्षार्थीले प्रत्येक प्रश्नको उत्तर छुट्टाछुट्टै 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 अन्तर्वार्तामा सम्मिलित गराइनेछ ।
- पाठ्यक्रम लागू मिति : २०७४ असोज २२ गते देखि

## प्रथम पत्र - शासकीय व्यवस्था र विकास

१. नेपालको वर्तमान संविधान र नेपालको संवैधानिक विकासक्रम ।
२. नेपालमा संघ, प्रदेश र स्थानीय तहको अधिकार, अन्तरसम्बन्ध र सीमाहरू ।
३. कार्यपालिका, व्यवस्थापिका र न्यायपालिकाको गठन ।
४. सार्वजनिक नीति तर्जुमा, कार्यान्वयन र विश्लेषण, अनुगमन र मूल्यांकन ।
५. सुशासन, पारदर्शिता, उत्तरदायित्व, निष्पक्षता र व्यावसायिकता ।
६. राजनीति र प्रशासन बीचको सम्बन्ध र सीमा ।
७. विद्युतीय शासन र नागरिक वडापत्रको अवधारणा ।
८. कानूनी राज्य, मानव अधिकार र भ्रष्टाचार नियन्त्रण
९. सामाजिक न्याय र सामाजिक सुरक्षा ।
१०. सार्वजनिक संस्थान, सार्वजनिक संस्थानको स्वायत्तता र उत्तरदायित्व
११. सार्वजनिक संस्थानको कार्यकुशलता मापनका आधार र कार्य सम्पादन सुधारका पक्षहरू
१२. नेपालमा सार्वजनिक संस्थान निजीकरणको अवस्था, सम्भाव्यता र आवश्यकता
१३. संस्थागत सुशासनको अवधारणा र सिद्धान्तहरू
१४. सार्वजनिक प्रशासनमा बदलिँदो अवधारणा र समसामयिक मामलाहरू
१५. नेतृत्वको अवधारणा, भूमिका, शैली र उपागम
१६. नेपालमा संस्थागत सुशासनका सम्बन्धमा रहेका कानूनी नीतिगत र संस्थागत व्यवस्था
१७. भूपरिवेष्टित राष्ट्रको अधिकार
१८. नेपाल आयल निगमबाट संस्थागत सुशासनका लागि गरिएका प्रयासहरू
१९. नेपाल आयल निगमको उद्देश्य, काम, कर्तव्य र अधिकार तथा समस्या र चुनौती
२०. निगम संचालक समितिको भूमिका तथा उत्तरदायित्व
२१. नेपाल आयल निगमको कर्मचारी प्रशासन सम्बन्धी व्यवस्था
२२. नेपाल आयल निगमको खरिद कार्यविधि सम्बन्धी व्यवस्था
२३. नेपालमा पेट्रोलियम पदार्थ आयात, ढुवानी तथा बिक्री वितरण सम्बन्धी व्यवस्था
२४. पेट्रोलियम पदार्थ गुणस्तर नियन्त्रण सम्बन्धी व्यवस्था
२५. पेट्रोलियम पदार्थ र यसबाट वातावरणमा पर्ने असर, प्रभाव, समस्या र समाधानका उपायहरू
२६. अन्तर्राष्ट्रिय तेल बजार : उत्पादन, बिक्री वितरण तथा मूल्य निर्धारण प्रणाली
२७. उपभोक्ताको हक हित संरक्षण सम्बन्धी अवधारणा
२८. कम्पनीको स्थापना तथा खारेजी प्रक्रिया सम्बन्धी कानूनी व्यवस्था
२९. करार तथा सम्झौताका आधारभूत पक्षहरू ।

## द्वितीय पत्र - सेवा सम्बन्धी

1. D.C. CIRCUIT ANALYSIS
  - 1.1 Circuit elements: Resistor, Inductor and Capacitor
  - 1.2 Dependent and Independent current source and voltage source
  - 1.3 Ohm's Law, Kirchoff's Law, Nodal and mesh analysis
  - 1.4 Series and parallel circuit, delta-star and star-delta transformation
  - 1.5 Network theorem: Thevenin's theorem, Norton's 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
  - 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 IT and IT to T transformation, two-port network connection.
  - 2.9 Generation of three phase voltages, star and delta connections, 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 inrush current, Transformer tests, Auto transformer connections, 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 characteristics, Losses and efficiency, Starting methods, Speed control of three phase induction motor types, 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 motors, V and Inverted V curves.
4. INSTRUMENTATION
  - 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 to Analog converters: Weighted resistor type and Ladder type D/A converters, Dual-ramp type and successive approximation.
  - 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
  - 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 principles of different types 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 and their 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
    - 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 Power system 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
    - 7.1 Fuse: Types, characteristics and operating principles
    - 7.2 Magnetic Contactors: Types, construction and operating principles
    - 7.3 Isolators (Disconnecting switches): types, construction and operating principles
    - 7.4 MCB and MCCB: Construction, operating principles and characteristics
    - 7.5 Relays: Electromagnetic and Static Relays, Over Current Relay, Impedance Relay, Directional Relay
    - 7.6 Circuit Breakers: ACB, OCB, ABCB, RCB 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
    - 8.1 Mathematical modeling: differential equation representation, transfer function notations and state space representations of a physical system
    - 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
    - 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
    - 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, and Demultiplexer
    - 9.3 Power Electronic Devices: Power Transistor, Power Diodes, 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
  - 10.1 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 outdoor 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
  
11. OPERATIONAL SAFETY AND HEALTH
  - 11.1 Effects of non- ionizing electromagnetic fields on human body
  - 11.2 Physical effects of electric shocks
  - 11.3 Safety and precaution
  - 11.4 Safety rules and regulations
  - 11.5 Safety tools and devices for fuel handling
  - 11.6 Explosions of fuel storage tanks and fuel handling equipment in premises and precautions to be taken
  - 11.7 Fire hazards, fire fighting techniques and equipment
  - 11.8 Noise hazard, sources, control and effect on health
  - 11.9 First aid requirements for post even treatment
  - 11.10 Safety culture; storage of dangerous materials
  - 11.11 Hazards due to high pressure & explosions , dust & vapor cloud explosions, vacuum temperature, inflammable materials, toxic materials, chemicals, chemical reactions and operations, electrostatics, ionizing radiation etc.
  - 11.12 Safety protection, equipments for personnel and plant for various hazards,safety procedures
  - 11.13 Disaster management, insurance, worker's safety Act etc.
  
12. PROFESSIONAL PRACTICE
  - 12.1 Ethics and Professionalism: Perspective on morals, codes of ethics and guidelines of professional engineering practice
  - 12.2 Legal aspects of Professional Engineering in Nepal. Provision for private practice and employee engineers
  - 12.3 Nepal Engineering Council Act, 2055 and regulations, 2056
  - 12.4 Relation with clients, contractor and fellow professionals.
  - 12.5 Public procurement practices for works, goods and services and its importance
  
13. COMPUTER AND INFORMATION SYSTEM
  - 13.1 Computer Structure (I/O devices, Storage devices, Memories) and typical processor architecture, CPU and memory organization, buses , Characteristics of I/O and storage devices, Processing Unit, memory systems ( main, auxiliary, virtual, cache).
  - 13.2 Digital Networks (LAN, WAN)
  - 13.3 Data types, Concept of Management Information System, concept of Operating Systems, Application software, Basic Concept on internet, e-mail and webpage ( such as DNS,IP,URL, http, ftp, IRQ, Routers ). Server (Web, email, printer), General concept of Cyber security (digital signature, SPAM, VIRUS, WORM, hiking, cracking), Unicode

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