काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन बोर्ड
प्राविधिक सेवा, इञ्जिनियरिङ समूह, इलेक्ट्रिकल इन्जिनियरिङ उपसमूह ७ तह, इलेक्ट्रिकल इञ्जिनियर पदको खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पाठ्यक्रमको रुपरेखा :– यस पाठ्यक्रमको आधारमा निम्नानुसारका चरणमा परीक्षा लिइने छ :

प्रथम चरण :– लिखित परीक्षा पूर्णाङ्क :– १००

द्वितीय चरण :– अन्तर्वार्ता पूर्णाङ्क :– ५०

परीक्षा योजना (Examination Scheme)

१. प्रथम चरण : लिखित परीक्षा (Written Examination) **पूर्णाङ्क :- १००**

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्नसंख्या X अङ्क	समय
प्रथम	सेवा समूह सम्बन्धी	१००	४०	वस्तुगत बहुवैकल्पिक (Multiple Choice)	५० प्रश्न x १ अङ्क	३ घण्टा
				विषयगत (Subjective)	१० प्रश्न x ५ अङ्क	

२. द्वितीय चरण : अन्तर्वार्ता (Interview) **पूर्णाङ्क :- ५०**

विषय	पूर्णाङ्क	परीक्षा प्रणाली
व्यक्तिगत अन्तर्वार्ता	५०	मौखिक

द्रष्टव्य :

१. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी हुनेछ ।
२. लिखित परीक्षामा यथासम्भव पाठ्यक्रमका सबै एकाईबाट प्रश्नहरु सोधिनेछ ।
३. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरुको 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 ।
४. विषयगत प्रश्नमा प्रत्येक पत्र/विषयका प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरु हुनेछन् । परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरुको उत्तर सोही खण्डका उत्तरपुस्तिकामा लेख्नुपर्नेछ ।
५. यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरु परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्क्रममा परेको सम्झनु पर्दछ ।
६. प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
७. पाठ्यक्रम लागू मिति :–

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पत्र/विषय :– सेवा समूह सम्बन्धी

खण्ड (क) – (५० अङ्क)

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; Series and parallel circuit, delta-star and star-delta transformation; Concept of complex Impedance and Admittance; RLC series and parallel circuit

2.2 Network Theorem: Thevenins theorem, Nortons theorem, Superposition theorem, Reciprocity theorem and Maximum power transfer theorem.

2.3 Resonance in series and parallel RLC circuit; Active, Reactive and Apparent power; Transient response of RLC circuit excited by DC and AC sources

2.4 Fourier analysis; Two-port network: Z, Y, T and h parameters, T to Π and Π to T transformation, two-port network connection; Three-phase circuit analysis, phase and line quantities

3. Control System

3.1 Mathematical modeling: differential equation representation, transfer function notations and state space representations of physical systems; Block diagram algebra, signal flow graphs

3.2 Transient and steady state response: impulse response, step and ramp response analysis of a 1st and 2nd order systems, overshoot and damping, steady state error and error constants; Effect of feedback on stability and steady state error

3.3 Stability: Relative and absolute stability, Routh -Herwitz criterion

3.4 Root locus: Manual plotting and judging the relative stability using root locus technique

3.5 Frequency response: Polar, and Bode plots, stability in frequency domain, gain margin and phase margins, Nyquist criterion for stability

3.6 Root locus: Manual plotting and judging the relative stability using root locus technique

3.7 Control system design: lead-lag and PID controllers and setting the controller parameters using Root locus and Bode plots

4. Electrical Machines

4.1 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

4.2 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

4.3 Induction machine: Constructional detail, Operating principle of three phase induction motor, Equivalent circuit, Torque-speed characteristic, Losses and efficiency, Staring methods, Speed control of three phase induction motor, Induction motor tests, Induction generator, Single phase induction motors- types, characteristics and applications

4.4 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

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 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 ofsolar photovotalic, 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 Computation of transmission line parameters, GMD and GMR, proximity effect and skin effect

6.2 Transmission line performance: Per unit system representation, Single line diagram, Lumped and distributed parameter modeling, ABCD parameters, efficiency and regulations calculations, Ferranti effect, surge impedance loading

6.3 Load flow: Basic Load flow equation, Gauss-Seidel and Newton-Rapshon methods

6.4 Over voltages in transmission lines: Power frequency, switching and lightning over voltages, surge arrestors

6.5 VAR compensation: Real and reactive power flow through transmission line, series and shunt compensations
6.6 Fault calculations: Symmetrical and unsymmetrical faults
6.7 Power system stability studies: Steady state and transient stability limits, swing equations, equal area criterion, stability enhancement techniques.
6.8 Corona: corona inception voltage, power loss, waveform deformation, RI and AN due to corona

खण्ड (ख) – (५० अङ्क)

7. Measurement and Instrumentation

7.1 Accuracy, Precision, Absolute and Relative Errors; Parallax Deflection type measuring instruments: Galvanometer, Ammeter, Voltmeter, Wattmeter, Watt-hour meter, Maximum Demand Meter, Frequency Meter
7.2 Instrument Transformers: Operating Principles of Measuring and Protection type CTs, Potential transformers
7.3 Transducers: Tachometer, Potentiometer; Measurement of electrical, mechanical, thermal and hydraulic variables
7.4 Measurement of low medium and high resistances by Ohmmeter method; Meggers and DC bridges; Measurement of inductance, capacitance and frequency by AC bridge circuits
7.5 Operational Amplifier: Signal Amplification, attenuation, differentiation, integration and adder; Operating principles of Analog and Digital Oscilloscope; Analog to Digital and Digital to Analog converters
7.6 Digital instrumentation: Fundamental principles, interfacing to the computers, Microprocessor based instrumentation

8. Power System Protection

8.1 Fuse, Magnetic Contactors, Isolators, MCB and MCCB: characteristics and operating principles
8.2 Relays: Electromagnetic and Static Relays, Over current Relay, Impedance Relay, Directional Relay
8.3 Circuit Breakers: ACB, OCB, ABCB, VCB and SF6 CB; construction, operating principles and applications
8.4 Protection schemes: Over current, under voltage, differential, distance protection
8.5 Grounding: System and equipment grounding, electric shock, safe value of current and voltages, touch and step potentials, Ground Fault Current Interrupters

9. Power Electronics

9.1 Devices: Power Transistor, Power Diodes, Thyristor, Triac, MOSFET, UJT, GTO – Construction and their characteristics
9.2 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
9.3 DC chopper: Step down chopper, Step up chopper.
9.4 Inverter: Single phase voltage inverter, three phase voltage inverter, current source inverter
9.5 Cyclo-converter: Single phase and three phase
9.6 AC voltage controller – with resistive load and inductive load

10. Occupational Safety and Health

10.1 Importance occupational safety and health

10.2 Physical effects of electric shock; safety and precaution; safety rules and regulation; safety tools and devices for electricity

10.3 Live line maintenance and precautions; earthing and shielding techniques; fire hazards; fire fighting techniques and equipment; First aid requirements after electrical accidents

11. Economics of Power Utilization

11.1 Economic considerations: Cost classification; interest and depreciation

11.2 Demand 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

11.3 Tariff: objective, factors affecting tariff, types of tariff

11.4 Illumination: Illumination and luminance, radiant efficiency, plane and solid angles, laws of illumination; polar curves, illumination requirement, design of in-door and out-door lighting scheme. Incandescent lamps, arc lamps, sodium discharge lamps, mercury fluorescent lamps, high pressure mercury vapor lamps, CFL and LED lamps

12. खानेपानी व्यवस्थापन तथा सरसफाई सम्बन्धी

12.1 काठमाण्डौ उपत्यकामा खानेपानीको वर्तमान अवस्था, संभावना र चुनौतीहरु

12.2 काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन वोर्डको परिचय, काम, कर्तव्य र अधिकार

12.3 नेपालमा खानेपानी व्यवस्थापनको भावी रणनीति र कार्यदिशा

12.4 काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन वोर्ड र काठमाण्डौ उपत्यका खानेपानी लिमिटेड वीचको अन्तरसम्वन्ध

12.5 मेलम्ची खानेपानी आयोजना संचालनको उद्देश्य, हालसम्मको प्रगति तथा आयोजनाले पार्ने सामाजिक प्रभाव

12.5.1 मेलम्ची खानेपानी उप आयोजना १ (मेलम्ची खानेपानी विकास समिति)

12.5.2 मेलम्ची खानेपानी उप आयोजना २ (आयोजना कार्यान्वयन निर्देशनालय - KUKL)

12.6 खानेपानी तथा सरसफाई क्षेत्रमा सार्वजनिक नीजि साझेदारी (PPP) को अवधारणा र जिम्मेवारी हस्तान्तरण

12.7 खानेपानी तथा सरसफाई सम्वन्धी दिगो विकास लक्ष्य (Sustainable Development Goals)

12.8 काठमाण्डौ काठमाडौं उपत्यकामा फोहोरमैला व्यवस्थापन, सरसफाई र ढल निकासको वर्तमान अवस्था, सम्भावना तथा चुनौतीहरु

12.9 काठमाण्डौ उपत्यका भित्र खानेपानी उत्पादन, प्रशोधन र वितरण प्रणाली सम्वन्धी जानकारी

12.10 वर्षातको पानी संकलन, पुनर्भरण तथा भूमिगत जल उपयोग सम्वन्धी कानूनी व्यवस्था

12.11 पम्प, प्यानल वोर्ड, वेल संचालन सम्वन्धी विविध जानकारी

13. संबिधान, ऐन, नियम र नीति

13.1 नेपालको संविधान

13.2 खानेपानी व्यवस्थापन वोर्ड ऐन, २०६३

13.3 काठमाडौ उपत्यका खानेपानी व्यवस्थापन बोर्ड नियमावली, २०६४

13.4 काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन वोर्ड कर्मचारी प्रशासन नियमावली

13.5 काठमाण्डौ उपत्यका भूमिगत जलश्रोत व्यवस्थापन नीति, २०६९

13.6 भूमिगत श्रोतको पानी निकाल्न तथा उपयोग गर्न अनुमती पत्र जारी गर्ने निर्देशिका, २०७१

13.7 टैंकर व्यवसाय संचालन अनुमतिपत्र जारी गर्ने निर्देशिका २०७३

13.8 राष्ट्रिय खानेपानी गुणस्तर मापदण्ड, २०६२
13.9 खानेपानी महशुल निर्धारण आयोग ऐन, २०६३
13.10 उपभोक्ता संरक्षण ऐन, २०५४ र उपभोक्ता संरक्षण नियमावली, २०५५
13.11 वातावरण संरक्षण ऐन, २०५३ र वातावरण संरक्षण नियमावली २०५४
13.12 जलश्रोत ऐन, २०४९ र जलश्रोत नियमावली, २०५०
13.13 भ्रष्टाचार निवारण ऐन, २०५९
13.14 विद्युत ऐन, २०४९ र विद्युत नियमावली, २०५०

यस पत्रको लागि यथासम्भव निम्नानुसार प्रश्नहरु सोधिने छ ।

पत्र/विषय :– सेवा समूह सम्बन्धी				
विषय	**खण्ड**	**अङ्कभार**	**वस्तुगत**	**विषयगत**
सेवा सम्वन्धी	**(क)**	५०	२५ प्रश्न X १ अङ्क = २५	५ प्रश्न X ५ अङ्क = २५
	(ख)	५०	२५ प्रश्न X १ अङ्क = २५	५ प्रश्न X ५ अङ्क = २५
जम्मा		**१००**	५० प्रश्न X १ अङ्क = ५०	१० प्रश्न X ५ अङ्क = ५०