काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन बोर्ड
प्राविधिक सेवा, इञ्जिनियरिङ समूह, हाइड्रोजियोलोजी उपसमूह, ७ तह, हाइड्रोजियोलोजिष्ट 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 :–

काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन बोर्ड
प्राविधिक सेवा, इञ्जिनियरिङ समूह, हाइड्रोजियोलोजी उपसमूह, ७ तह, हाइड्रोजियोलोजिष्ट पदको खुला
प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पत्र/विषय :– सेवा समूह सम्बन्धी

खण्ड (क) – (५० अङ्क)

1. Physical Geology, Geology of Nepal Himalaya and Regions

1.1. Science of geology, its branches and geological time scale
1.2. Internal structure of the earth - the crust, mantle and core, lithosphere and asthenosphere, interior temperature and pressure of the earth
1.3. Plate tectonics
1.4. Earthquake and its mechanism, seismic waves, seismograph, magnitude and intensity of earthquakes, liquefaction, forecast and prediction of earthquakes, earthquakes in Nepal
1.5. Drainage pattern and weathering and soil erosion
1.6. Geological work of running water, groundwater and glacier.
1.7. Structures and stratigraphy of different tectonic divisions of Nepal Himalaya (Terai plain, Siwalik, Lesser Hiamalaya, Higher Himalaya and Tibetan Tethys Himalaya)

2. Structural Geology

2.1. Scope of structural geology in geology, geological map and cross-section
2.2. Stress and strain, Mohr circle and its use
2.3. Primary sedimentary structures and their significance in stratigraphy and structural geology, unconformities
2.4. Fold morphology - classification of folds, fold mechanism, criteria of recognition of fold in the field
2.5. Fault geometry and morphology - classification and criteria of recognition of faults
2.6. Joints and fractures
2.7. Lineation, cleavage, foliation and schistosity and their classifications, relationship of lineation and foliation with other structures in the field

3. Stratigraphy and Sedimentology

3.1. Principle of stratigraphy and law of superposition
3.2. International codes and contentions for stratigraphic classification and nomenclature
3.3. Unit and measurement of geological time and geochronology
3.4. Distribution of sediments and sedimentary rocks, formation of sediments, sedimentary particles, grain size distribution, shape of sedimentary particles, factors controlling particle morphology
3.5. Structure of sedimentary rocks: Bedding and cross lamination, graded bedding, ripple marks, sole marks, mud cracks, stromatolites

4. Mineralogy and Petrology (Igneous and Metamorphic petrology)

4.1. Definition of mineral and rocks. silicate and non-silicate minerals, Moho-hardness scale, physical and chemical properties of rock forming minerals
4.2. Characteristics and classification of igneous, sedimentary and metamorphic rocks, rock cycle

5. Engineering Geology

5.1. Role of engineering geology in planning, design, construction and maintenance of infrastructures, Engineering geological maps - types and contents, hazard map and method of its preparation.

5.2. Index properties of soil: unit weight, porosity, void ratio, degree of saturation, cohesive and non-cohesive soil, soil consistency, classification of engineering soil, unified soil classification

5.3. Landslides and mass movements, causes and classification, control measures, landslides in Nepal

5.4. Irrigation canals: site selection, problems of instabilities, erosion and sedimentation, measures for their control

5.5. Slope stability analysis, construction material

5.6. Concept of geohazard, risk and vulnerability

6. Hydrogeology

6.1. Introduction: Hydrological cycle. Occurrences of ground water. Hydrogeological properties of rocks and sediments. Vertical distribution of ground water. Types of aquifer, aquifer parameters, springs.

6.2. Ground water movements: Darcys Law and its validity. Hydraulic conductivity and its determination by laboratory and field methods. Well hydraulics, steady state and unsteady state radial flow. Pumping tests.

6.3. Water wells: Different kinds of well structures, Methods of drilling in hard rocks, soft rocks and unconsolidated sediments for groundwater development. Well construction methods, well design and well development. Well rehabilitation, estimation of well efficiency. Pumping equipments for shallow and deep wells.

6.4. Influence of environmental factors on ground water level: Secular, seasonal, diurnal and incidental changes.

6.5. Quality of groundwater: Causes and measures of water quality, standard for different purposes of usage, sources of ground water pollution

6.6. Ground water Resources of Nepal: Ground condition in different Geological formations; Ground water potential of Nepal

7. Origin, Occurrence and Movement of Groundwater

7.1. Hydrologic cycle, groundwater storage, water table and artesian aquifers (unconfined and confined aquifers), influent and affluent streams, factors influencing infiltration, groundwater flow, lithology of aquifers, Darcy's Law, porosity, permeability, hydraulic gradient, safe yield

8. Testing Water Wells for Drawdown and Yield and Well Hydraulics

8.1. Objective of tests, measuring pumping rates, water level measurements, aquifer tests, estimating well yield, estimating open pipe flow, Nature of converging flow, cone of depression, equilibrium well equation, yield vs. well size, yield vs. draw down, non-equilibrium well equation, modified non-equilibrium equation, time-

drawdown relations, boundary effects, distance-drawdown relations, partial penetration of aquifers, water level recovery, well interference, radius of influence, well efficiency

खण्ड (ख) – (५० अङ्क)

9. Groundwater Quality and Water Treatment

9.1. Chemical components affecting groundwater quality (atmospheric, human and industrial waste, agricultural practices, disasters), processes affecting groundwater quality (soil type, human activities, and groundwater flow on contaminants), groundwater quality monitoring (selection of water quality parameters, sampling methods and density of observation networks, data processing and analysis, preventing measures and implementation), determining groundwater quality (hydrogeological, chemical, physical, and biological)

9.2. Mineral analysis, units of measurements, hardness, electrical conductance, pH, dissolved minerals, water quality requirements, drinking water standards, aeration, iron and manganese removal, softening, demineralization, disinfecting wells - Use of hypochlorites, chlorination while drilling, filtration, disinfection by various methods

9.3. Presence of arsenic in the groundwater of Nepal, source of arsenic and its remedy.

9.4. Presence of arsenic iron in the ground water of kathmandu valley its remedy.

10. Groundwater Exploration and Well Drilling Methods

10.1. Geologic and hydrologic studies, exploratory drilling, methods of sampling, electric logging, gamma-ray logging, electrical resistively surveying, seismic refraction surveying. Basic principles of well drilling, cable-tool percussion method, direct rotary drilling, drilling fluid and drilling mud, reverse circulation drilling, jet drilling, air rotary drilling, driven wells, pipe casing selection, grouting and sealing casing, plumbness and alignment

11. Water Well Design Screens Selection

11.1. Grain-size analysis, plotting sand analysis curves, descriptive size classifications, types of grain-size curves

11.2. Selection of housing and casing pipe, well screen design, selection of well screen (continuous slot type, shutter type, slotted pipe), casing diameter, casing material, well depth, well screen length, well screen diameter, well screen slot openings, selection of well screen material, well screen design, pressure relief screens, formation stabilizer, open area, entrance velocity, screen transmitting capacity, gravel pack design, sanitary protection

11.3. Installation of well screens: Pull-back method, use of pilot hole, open bottom screens, wash-down method, well points, gravel packed screens, removing well screens for cleaning or reuse

11.4. Well point system: Multiple wells for water supply, installing well points, dewatering well point systems, design and layout, header and swing joints

12. Developing and Completing Water Wells

12.1. Importance of development work, sand bridging, mechanical surging, surging with compressed air, over pumping, back washing, high velocity jetting, successful development procedures

12.2. Water well Pumps: Kinds of pumps, suction and cavitation, positive displacement pumps, variable displacement pumps, centrifugal pumps, jet pumps, air lift pumping, pump selection

13. Conservation and Management of Groundwater

13.1. Conservation attitudes, optimum development of aquifers, subsurface water storage, artificial recharge, role and function of groundwater, conjunctive management of groundwater and surface water, pollution control, groundwater level control - structural measures, administrative measures, monitoring, implementation measures for groundwater management

14. Groundwater Resources of Kathmandu

14.1. History of groundwater study in Kathmandu, review of hydrological data, groundwater resources, groundwater use, groundwater recharge calculation, methods of groundwater estimate, groundwater balance, existing practice, challenge and opportunities

15. Precipitation Infiltration and Water Losses

15.1. Water vapour, measurement of humidity, variations in humidity, condensation, types of precipitation, thunderstorms, formation of raindrops, measurement of rainfall, use of radar, annual precipitation, variation in annual rainfall, mean rainfall in basin, testing and adjusting precipitation records, frequency of intense rainfalls, relation between storm frequency and mean annual rainfall, intensity duration curves, variation of average precipitation with area, maximum precipitation

15.2. Soil moisture: Definition of infiltration, factors affecting infiltration capacity, soil moisture, compaction due to rain, compaction due to man and animals, vegetative cover, temperature, annual and seasonal changes, methods of determining infiltration (f) infiltrometers, rain simulators, hydrograph analysis, determination of the ‘f’ curve

15.3. Water losses: Evaporation from free water surfaces, influence of depth, methods of determining evaporation, storage equation method, pan measurements, evaporation formulas, use of humidity and wind velocity gradients, transpiration ratio, measurement of transpiration, soil evaporation, influence of high or low water table, measurement of soil evaporation, total water loss, factors affecting total water loss

16. Runoff and Stream Flow Records

16.1. The hydrograph: Terms and units, sources of runoff, the runoff process, soil moisture and groundwater, variability of stream flows, classification of streams, groundwater depletion curves, hydrograph analysis

16.2. Runoff: Surface runoff, relation between surface detention and discharge, synthesis of a hydrograph, unit hydrograph, prediction of runoff from rainfall, determination of unit hydrograph, duration curve

16.3. Factors affecting runoff: Type of precipitation, rain intensity, duration of rainfall, distribution of rainfall on basin, direction of storm movement, the drainage net, indirect drainage, artificial drainage

16.4. Stream flow records: Methods of obtaining discharge records, weir stations, control meters, velocity area stations, measurement of velocity, rating of current meter, type of current meters, methods of making discharge measurements, measurement of area, mean velocity in vertical, spacing of verticals, plotting and extending the stage discharge curve, measurement of peak flood flow

17 खानेपानी व्यवस्थापन तथा सरसफाई सम्बन्धी

17.1काठमाण्डौ उपत्यकामा खानेपानीको वर्तमान अवस्था, संभावना र चुनौतीहरु

17.2काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन वोर्डको परिचय, काम, कर्तव्य र अधिकार

17.3नेपालमा खानेपानी व्यवस्थापनको भावी रणनीति र कार्यदिशा

17.4काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन वोर्ड र काठमाण्डौ उपत्यका खानेपानी लिमिटेड वीचको अन्तरसम्वन्ध

17.5खानेपानी महशुल निर्धारण सम्वन्धी व्यवस्था

17.6मेलम्ची खानेपानी आयोजना संचालनको उद्देश्य, हालसम्मको प्रगति तथा आयोजनाले पार्ने सामाजिक प्रभाव

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

17.6.2मेलम्ची खानेपानी उप आयोजना २ (आयोजना कार्यान्वयन निर्देशनालय - KUKL)

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

17.8खानेपानी तथा सरसफाई सम्वन्धी दिगो विकास लक्ष्य (Sustainable Development Goals) र

17.9काठमाण्डौ काठमाडौं उपत्यकामा फोहोरमैला व्यवस्थापन, सरसफाई र ढल निकासको वर्तमान अवस्था, सम्भाव्यता तथा चुनौतीहरु

17.10काठमाण्डौ उपत्यकामा खानेपानी उत्पादन, प्रशोधन र वितरण प्रणाली सम्वन्धी जानकारी

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

18 संबिधान, ऐन, नियम र नीति

18.1 नेपालको संविधान

18.2 खानेपानी व्यवस्थापन वोर्ड ऐन, २०६३

18.3 काठमाडौ उपत्यका खानेपानी व्यवस्थापन बोर्ड नियमावली, २०६४

18.4 काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन वोर्ड कर्मचारी प्रशासन नियमावली

18.5 टैंकर व्यवसाय संचालन सम्वन्धी अनुमतिपत्र जारी गर्ने निर्देशिका २०७३

18.6 काठमाण्डौ उपत्यका भूमिगत जलश्रोत व्यवस्थापन नीति, २०६९

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

18.8 राष्ट्रिय खानेपानी गुणस्तर मापदण्ड, २०६२

18.9 खानेपानी महशुल निर्धारण आयोग ऐन, २०६३

18.10 उपभोक्ता संरक्षण ऐन, २०५४ र उपभोक्ता संरक्षण नियमावली, २०५५

18.11 वातावरण संरक्षण ऐन, २०५३ र वातावरण संरक्षण नियमावली २०५४

18.12 जलश्रोत ऐन, २०४९ र जलश्रोत नियमावली, २०५०

18.13 भ्रष्टाचार निवारण ऐन, २०५९

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