काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन बोर्ड
प्राविधिक सेवा, इञ्जिनियरिङ समूह, सिभिल इञ्जिनियर उपसमूह, ७ तह, सिभिल 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 :–

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

पत्र/विषय :– सेवा समूह सम्बन्धी

खण्ड (क) – (५० अङ्क)

1. Fluid Mechanics and Hydraulic Machinery

1.1 Fluid properties, Hydrostatic forces and Fluid kinematics
1.2 Fluid dynamics, Flow measurement, Notches and Weir, Viscous flow theory
1.3 Fluid through pipes, Turbulent flow, Boundary Layer theory
1.4 Open channel flow
1.5 Pumps, Jets and Turbines

2. Structural Analysis and Design

2.1 Stress and strain; theory of torsion and flexure; moment of inertia
2.2 Analysis of beams and frames: bending moment, shear force and deflection of beams and frames: determinate stricture - energy methods; three hinged systems, indeterminate structures-slope deflection method and moment distribution method; use of influence line diagrams for simple beams, unit load method
2.3 Reinforced concrete structure: Difference between working stress and limit state philosophy, analysis of RC beams and slabs in bending, shear, deflection, bond and end anchorage, Design of axially loaded columns; isolated and combined footings, introduction to pre-stressed concrete
2.4 Steel and timber structures: Standard and built-up sections: Design of riveted, bolted and welded connections, design of simple elements such as ties, struts, axially loaded and eccentric columns bases, Design principles on timber beams and columns

3. Concrete Technology

3.1 Constituents and properties of concrete (physical and chemical)
3.2 Water cement ratio
3.3 Grade and strength of concrete, concrete mix design, testing of concrete
3.4 Admixtures
3.5 High strength concrete
3.6 Pre-stressed concrete technology

4. Construction Materials

4.1 Properties of building materials: physical, chemical, constituents, thermal, etc.
4.2 Stones – characteristics and requirements of stones as a binding materials
4.3 Ceramic materials: ceramic tiles, mosaic tile, brick types and testing
4.4 Cementing materials: types and properties of lime and cement; cement mortor tests
4.5 Metals: Steel; types and properties ; Alloys
4.6 Timber and wood: timber trees in Nepal ,types and properties of wood
4.7 Miscellaneous materials: Asphaltic materials (Asphalt, Bitumen and Tar); paints and varnishes; polymers
4.8 Soil properties and its parameters

5. Construction Management

5.1 Construction scheduling and planning: networks techniques(CPM,PERT) and bar charts

5.2 Contractural procedure and management: types of contract, tender and tender notice, preparation of binding (tenser) document, contractors pre-qualification, evaluation of tenders and selection of contractor, contract acceptance, condition of contract; quotation and direct order ,classification of contractors; dispute resolution; muster roll
5.3 Material management: procurement procedures and materials handelling
5.4 Quality Control Plan, Cost Control and Quality Control Mechanisms
5.5 Project maintenance
5.6 Occupational health and safety
5.7 Project monitoring and evaluation
5.8 Technical Auditing
5.9 Variation, alteration and omissions

6. Water Resources and Hydrology

6.1 General aspects of hydrology
6.2 Infiltration, Runoff and Hydrograph
6.3 Planning and design of water storage reservoir
6.4 Floods, flood routing and flood control measures

7. Soil Mechanics and Foundations

7.1 Soil characteristics, soil properties, classifications, effective stresses, permeability and well hydraulics
7.2 Compressibility, consolidation and compaction
7.3 Earth pressure theories
7.4 Terzaghi's bearing capacity theories and their applications
7.5 Water-water relationship

8. Drawing Techniques

8.1 Drawing sheet composition and its essential components
8.2 Suitable scales, site plans, preliminary drawings, working drawings
8.3 Theory of projection drawing: perspective, orthographic and axonometric projection; first and third angle projection
8.4 Drawing tools and equipments
8.5 Drafting conventions and symbols
8.6 Topographic, electric, plumbing and structural drawings
8.7 Techniques of free hand drawing

9. Estimating and Costing Valuation and Specification

9.1 Types of estimates and their specific uses
9.2 Methods of calculating quantities
9.3 Key components of estimating norms and rate analysis
9.4 Preparation of bill of quantities
9.5 Purpose, types and importance of specification
9.6 Purpose, principles and methods of valuation

10. Engineering Survey

10.1 Introduction and basic principles

10.2 Linear measurements: techniques; chain, tape, ranging rods and arrows; representation of measurements and common scales; sources of errors; effect of slop and slope correction; correction for chain and tape measurements; Abney level and clinometers

10.3 Compass and plane table surveying: bearings; types of compass; problems and sources of errors of compass survey; principles and methods of plane tabling

10.4 Leveling and contouring : principle of leveling; temporary and permanent adjustment of level; bench marks; booking methods and their reductions; longitudinal and cross sectioning; reciprocal leveling; trigonometric leveling; contour interval and characteristics of contours; method of contouring

10.5 Theodolite traversing :need of traverse and its significance; computation of coordinates; adjustment of closed traverse ;closing errors

10.6 Use of Total Station and Electronic Distance Measuring Instruments

11. Engineering Economics

11.1 Benefit cost analysis, cost classification, sensitivity analysis, internal rate of return, time value of money; economic equilibrium, demand, supply and production, net present value, financial and economic evaluation

12. Engineering Professional Practices

12.1 Ethics and professionalism: code of conduct and guidelines for professional engineering practices

12.2 Nepal Engineering Council Act, 2055 and Regulations, 2056

12.3 Relation with clients, contractor and fellow professionals

12.4 Public procurement practices for works, goods and services and its importance

खण्ड (ख) – (५० अङ्क)

13. Water Supply

13.1 Introduction

- 13.1.1 Importance and necessity of Water Supply Scheme
- 13.1.2 Importance and Reliability of Water Works
- 13.1.3 Essentials of Water Supply Engineering

13.2 Water Demands

- 13.2.1 Various Types of Water Demands
- 13.2.2 The Per capita Demand
- 13.2.3 Factor affecting Per Capita Demand
- 13.2.4 Variation in Demand
- 13.2.5 Design periods
- 13.2.6 Population Data and Population Growth and Population Forecasting Methods

13.3 General Hydrology

- 13.3.1 Hydrological cycle
- 13.3.2 Precipitation and Type of Precipitation
- 13.3.3 Rainfall and its Distribution
- 13.3.4 Run-off and Estimation of Run-off

- 13.3.5 Evaporation Losses from Water Sources
- 13.3.6 Determination of Evaporation Losses
- 13.3.7 Percolation Losses
- 13.3.8 Losses due to Transpiration

13.4 Source of Water

- 13.4.1 Surface source: Lakes, Streams, Rivers, Impounded Reservoirs, Stored rain water Cistern, Waste water reclamation and sea water
- 13.4.2 Ground Water source: Infiltration Galleries, Infiltration Wells, Springs, open well or dug well, Tube wells
- 13.4.3 Development of Ground Water
  - 13.4.3.1 Occurrence of Ground Water
  - 13.4.3.2 Geological Factors Governing the Occurrence of Ground Water
  - 13.4.3.3 Zones of Underground Water
  - 13.4.3.4 Movement of Ground Water and its Velocity
  - 13.4.3.5 Coefficient of Permeability
  - 13.4.3.6 Ground Water Yield
  - 13.4.3.7 Aquifer and Their Types
  - 13.4.3.8 Yield of Wells and Tube Wells
  - 13.4.3.9 Spherical Flow in Wells
  - 13.4.3.10 Interference among the Wells
  - 13.4.3.11 Well loss and Specific Capacity of Wells and Well Design

13.5 Intakes

- 13.5.1 Factors governing the Location of an Intake
- 13.5.2 Types of Intakes: River Intake, Canal Intake, Reservoir Intake, Lake Intake and Intake Conduit

13.6 Conduits for Transporting Water

- 13.6.1 Various Types of Conduits
- 13.6.2 Hydraulics of Flow and Design of Pressure Pipes as Gravity mains
- 13.6.3 Flow in Pipe System
- 13.6.4 Forces Acting on the Pressure Conduits
- 13.6.5 Various Types of Pressure pipes
- 13.6.6 Pipe Appurtenances

13.7 Pumps for Lifting Water

- 13.7.1 Types of Pumps
- 13.7.2 Factors affecting the selection of Pump
- 13.7.3 Efficiency of Pumps
- 13.7.4 Economical diameter of the Pumping Mains

13.8 Quality of Waster

- 13.8.1 Characteristics of Water
- 13.8.2 Water-borne Diseases and their Control
- 13.8.3 Water Quality Standards: WHO Standards, Nepal Standard

13.9 Water pollution

- 13.9.1 Introduction

13.9.2 Sources of Water Pollution
13.9.3 Types of Pollution
13.9.4 Preventive measures

13.10 Water Treatment
13.10.1 Objective of Treatment
13.10.2 Treatment Components: Screening, Plain Sedimentation, Sedimentation with Coagulation, Chemical used for Coagulation, Jar Test
13.10.3 Filtration: Theory of Filtration, Filter Materials, Types of Filter, Slow sand filter, Rapid sand Filter, Pressure filter, Membrane filter, RO and Other types of Filter
13.10.4 Design of Sedimentation, slow Sand Filter, Rapid Sand Filter and Pressure Filter

13.11 Water Softening
13.11.1 Method of Removing Temporary Hardness
13.11.2 Method of Removing Permanent Hardness

13.12 Disinfection of Water
13.12.1 Method of disinfection
13.12.2 Chlorination and Disinfecting Action of Chlorine
13.12.3 Various forms in which Chlorine can be applied
13.12.4 Types of Chlorination, Break point Chlorination
13.12.5 Testing of Chlorine Residuals

13.13 Distribution System
13.13.1 Layout of Distribution Networks
13.13.2 Method of Distribution
13.13.3 Pressure in Distribution System and System of Supply
13.13.4 Function and Types of Distribution Reservoir
13.13.5 Storage capacity, Location and Height of Distribution Reservoir
13.13.6 Wastage and Leakage of Water in Distribution System
13.13.7 Design of Distribution Networks

13.14 Appurtenances in the Distribution system
13.14.1 Fire Hydrants
13.14.2 Water Meters

13.15 Operation and Maintenance of Water Supply System
13.15.1 Definition of Operation and Maintenance
13.15.2 Difference between Maintenance and rehabilitation

14. Sanitary Engineering

14.1 Introduction
14.1.1 Importance of waste Water and solid waste management
14.1.2 Meaning and objective of Sewage Disposal
14.1.3 System of Collection: conservancy System and Water carriage system
14.1.4 Types of Sewerage System

14.2 Quantity of Waste Water
14.2.1 Source of Sanitary Sewage

- 14.2.2 Factors Affecting Sanitary sewage
- 14.2.3 Determination of Quantity of Sanitary Sewage

14.3 Quantity of Storm Sewage
- 14.3.1 Factors Affecting Storm sewage
- 14.3.2 Determination of Quantity of Storm-Water: Rational Method and Empirical Formulae Method

14.4 Design of Sewers
- 14.4.1 Introduction
- 14.4.2 Hydraulic Formulae for design of Sewers
- 14.4.3 Minimum Velocity of flow in sewers- Self cleaning
- 14.4.4 Maximum Velocity of Flow in sewers
- 14.4.5 Effect of variation in Flow of Sewage on Velocity of Flow in Sewers

14.5 Construction of Sewers
- 14.5.1 Factors affecting the selection of Material for sewer Construction
- 14.5.2 Materials for Sewers, Joint in Sewers and Shape of Sewers
- 14.5.3 Structural Design of Sewers
- 14.5.4 Construction of Sewers: Excavation, laying, jointing and testing of sewers
- 14.5.5 Maintenance, Cleaning and Ventilation of sewers

14.6 Sewers Appurtenances
- 14.6.1 Inlets, Catch Basins, Clean-Outs, manholes, Lamp-Holes, Flushing Devices
- 14.6.2 Grease and Oil Traps, Inverted Siphons and Storm Water Overflow Devices

14.7 Sewage Treatment
- 14.7.1 Objective of Treatment, Treatment method: Physical, Chemical and Biological
- 14.7.2 Preliminary Treatment of Sewage: screening-Screens, Grit Chambers, Sedimentation and Chemical Aided sedimentation Tank
- 14.7.3 Biological Treatment of Sewage:
  - 14.7.3.1 Classification of Biological Treatment process
  - 14.7.3.2 Activated sludge Process
  - 14.7.3.3 Types of Activated Sludge Process
  - 14.7.3.4 Method of Aeration in activated Sludge Process
- 14.7.4 Sewage Filtration
  - 14.7.4.1 Types of sewage Filters
  - 14.7.4.2 Construction and design of Standard Trickling Filters, High Rate Trickling Filter and Bio-Filters
- 14.7.5 Miscellaneous Methods
  - 14.7.5.1 Oxidation Ditch, Oxidation Ponds, Aerobic Ponds, Anaerobic Ponds, Aerated Lagoons

14.8 Sewage Disposal
- 14.8.1 Sludge Treatment Process
- 14.8.2 Characteristics and quantity of Sludge

14.8.3 Sludge Thickening
14.8.4 Sludge Digestion, Sludge conditioning, sludge Dewatering
14.8.5 Final Disposal of Sludge
14.9 Onsite Disposal Method
14.9.1 Pit privy, Bore-hole privy Septic tank, Leaching Cesspools,
14.9.2 Disposal of Septic tank Sludge and Effluent

15. Environment and Climate Change

15.1 Introduction of Water pollutants, its causes, impact and remedial measures
15.2 Human excreta and its characteristics, pollution caused by excreta, health aspects
15.3 Solid waste management
15.3.1 Types and characteristics of solid waste
15.3.2 Garbage collection and disposal
15.3.3 Method of solid waste disposal: dumping, sanitary land fill, incineration and composting
15.4 Concept of Environmental Assessment
15.4.1 Initial Environmental Examination (IEE)
15.4.2 Environmental Impact Assessment (EIA), role of EIA
15.4.3 Types of Environmental Impacts, and EIA principles
15.4.4 Government rules and Regulation and procedures for EIA
15.5 Climate change management in water supply
15.5.1 General concept of global climate change phenomenon
15.5.2 National, Local and Secteral Adaption Plan of Action (NAPA, LAPA and SAPA)
15.5.3 Climate change treats on water supply projects
15.5.4 Vulnerability analysis and adaption plan for climate change effect on water supply projects

16. खानेपानी व्यवस्थापन तथा सरसफाई सम्बन्धी

16.1 काठमाण्डौ उपत्यकामा खानेपानीको वर्तमान अवस्था, संभावना र चुनौतीहरु
16.2 काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन वोर्डको परिचय, काम, कर्तव्य र अधिकार
16.3 नेपालमा खानेपानी व्यवस्थापनको भावी रणनीति र कार्यदिशा
16.4 काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन वोर्ड र काठमाण्डौ उपत्यका खानेपानी लिमिटेड वीचको अन्तरसम्वन्ध
16.5 खानेपानी महशुल निर्धारण सम्वन्धी व्यवस्था
16.6 मेलम्ची खानेपानी आयोजना संचालनको उद्देश्य, हालसम्मको प्रगति तथा आयोजनाले पार्ने सामाजिक प्रभाव
16.6.1 मेलम्ची खानेपानी उप आयोजना १ (मेलम्ची खानेपानी विकास समिति)
16.6.2 मेलम्ची खानेपानी उप आयोजना २ (आयोजना कार्यान्वयन निर्देशनालय - KUKL)
16.7 खानेपानी तथा सरसफाई क्षेत्रमा सार्वजनिक नीजि साझेदारी (PPP) को अवधारणा र जिम्मेवारी हस्तान्तरण
16.8 खानेपानी तथा सरसफाई सम्वन्धी दिगो विकास लक्ष्य (Sustainable Development Goals)
16.9 काठमाण्डौ काठमाडौं उपत्यकामा फोहोरमैला व्यवस्थापन, सरसफाई र ढल निकासको वर्तमान अवस्था, सम्भाव्यता तथा चुनौतीहरु
16.10 काठमाण्डौ उपत्यकामा खानेपानी चुहावटको विद्यमान समस्या समाधानका उपायहरु

16.11 काठमाण्डौ उपत्यका भित्रको खानेपानी उत्पादन, प्रशोधन र वितरण प्रणाली सम्वन्धी जानकारी
16.12 वर्षातको पानी संकलन, पुनर्भरण तथा भूमिगत जल उपयोग सम्वन्धी कानूनी व्यवस्था

17. संबिधान, ऐन, नियम र नीति

17.1 नेपालकोसंविधान
17.2 खानेपानी व्यवस्थापन वोर्ड ऐन, २०६३
17.3 काठमाडौ उपत्यका खानेपानी व्यवस्थापन बोर्ड नियमावली, २०६४
17.4 काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन वोर्ड कर्मचारी प्रशासन नियमावली
17.5 काठमाण्डौ उपत्यका भूमिगत जलश्रोत व्यवस्थापन नीति, २०६९
17.6 भूमिगत श्रोतको पानी निकाल्न तथा उपयोग गर्न अनुमती पत्र जारी गर्ने निर्देशिका, २०७१
17.7 राष्ट्रिय खानेपानी गुणस्तर मापदण्ड, २०६२
17.8 खानेपानी महशुल निर्धारण आयोग ऐन, २०६३
17.9 उपभोक्ता संरक्षण ऐन, २०५४ र उपभोक्ता संरक्षण नियमावली, २०५५
17.10 वातावरण संरक्षण ऐन, २०५३ र वातावरण संरक्षण नियमावली २०५४
17.11 जलश्रोत ऐन, २०४९ र जलश्रोत नियमावली, २०५०
17.12 भ्रष्टाचार निवारण ऐन, २०५९
17.13 सार्वजनिक खरिद ऐन, २०६३ र सार्वजनिक खरिद नियमावली, २०६४
17.14 टैंकर व्यवसाय संचालन अनुमतिपत्र जारी गर्ने निर्देशिका २०७३

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