काठमाडौं उपत्यका खानेपानी लिमिटेड

प्राबिधिक सेवा, सिभिल समूह, ७ तह, इन्जिनियर पदको खुल्ला तथा समाबेशी र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

पाठ्यक्रमको रुपरेखा :– यस पाठ्यक्रमको आधारमा निम्नानुसार दुई चरणमा परीक्षा लिइने छ :
प्रथम चरण :– लिखित परीक्षा पूर्णाङ्क :– २००
द्वितीय चरण :– अन्तर्वार्ता पूर्णाङ्क :– ४०

प्रथम चरण – लिखित परीक्षा योजना **(Examination Scheme)**

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या **x**अङ्कभार	समय
प्रथम	सिभिल इञ्जिनियरिङ्ग सम्बन्धी विषय	१००	४०	वस्तुगत बहुउत्तर (Multiple Choice)	१००x१ = १००	१ घण्टा १५ मिनेट
द्वितीय	Water Supply and Sanitary Engineering and Environment सम्बन्धी	१००	४०	विषयगत (Subjective)	१०x५ = ५० र ५ X १० = ५०	३ घण्टा

द्वितीय चरण

विषय	पूर्णाङ्क	परीक्षा प्रणाली	समय
व्यक्तिगत अन्तर्वार्ता	३०	मौखिक	-

१. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ ।
२. पाठ्यक्रमको प्रथम र द्वितीय पत्रको विषयवस्तु फरक फरक हुनेछन ।
३. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।

४. प्रथम पत्रका पाठ्यक्रमका एकाईहरुबाट सोधिने प्रश्नहरुको संख्या निम्नानुसार हुनेछ । द्वितीय पत्रको पाठ्यक्रमका एकाईहरुबाट सोधिने प्रश्नहरुको संख्या द्वितीयपत्रको पाठ्यक्रम उल्लेख भए अनुसार हुनेछ ।

प्रथमपत्रका एकाई	1	2	3	4	5	6	7	8	9
प्रश्न संख्या	20	15	12	12	10	10	8	8	5

५ . 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 ।

६ . बहुवैकल्पिक प्रश्नहरु हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।

७. विषयगत प्रश्नका लागि द्वितीय पत्रको विषयगत प्रश्नका लागि १० अङ्कका ५ ओटा लामो प्रश्न र ५ अङ्कका १० ओटा छोटो प्रश्न सोधीने छन।

८. द्वितीय पत्रमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरु हुनेछन् । परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरुको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

काठमाडौं उपत्यका खानेपानी लिमिटेड

प्राबिधिक सेवा, सिभिल समूह, ७ तह, इन्जिनियर पदको खुल्ला तथा समाबेशी र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

९. यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तमा 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 सम्झन पर्दछ ।

१०. प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।

११. यस भन्दा अगाडि लागू भएको माथि उल्लिखित समूहको पाठ्यक्रम खारेज गरिएको छ ।

१२. पाठ्यक्रम लागू मिति :– २०७४ आश्विन देखि

प्रथम पत्र: **General Civil Engineering [100 Marks]**

1. Structure Analysis and Design

1.1 Stresses and strains; theory of torsion and flexure; moment of inertia

1.2 Analysis of beams and frames: Bending moment, shear force and deflection of beams and frames: determinate structure - 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

1.3 Reinforced concrete structures: 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

1.4 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, column bases, Design principles on timber beams and columns

2. Construction Materials

2.1 Properties of building materials: physical, chemical, constituents, thermal etc.

2.2 Stones-characteristics and requirements of stones as a building materials

2.3 Ceramic materials: ceramic tiles, Mosaic Tile, brick types and testing etc.

2.4 Cementing materials: types and properties of lime and cement; cement mortar tests

2.5 Metals: Steel; types and properties; Alloys

2.6 Timber and wood: timber trees in Nepal, types and properties of wood

2.7 Miscellaneous materials: Asphaltic materials (Asphalt, Bitumen and Tar); paints and varnishes; polymers

2.8 Soil properties and its parameter

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 Mixing, transportation pouring and curing of concrete
3.5 Admixtures
3.6 High strength concrete
3.7 Pre-stressed concrete technology

4. Construction Management

4.1 Construction scheduling and planning: network techniques (CPM, PERT) and bar charts
4.2 Contractual procedure and management: types of contract, tender and tender notice, preparation of bidding (tender) document, contractor's pre-qualification, evaluation of tenders and selection of contractor, contract acceptance, condition of contract; quotation and direct order, classifications of contractors; dispute resolution; muster roll
4.3 Material management: procurement procedures and materials handling
4.4 Cost control and quality control
4.5 Project maintenance
4.6 Occupational health and safety
4.7 Project monitoring and evaluation
4.8 Quality assurance plan
4.9 Variation, alteration and omissions

5. Estimating, Costing, Valuation and Specification

5.1 Types of estimates and their specific uses
5.2 Methods of calculating quantities
5.3 Key components of estimating norms and rate analysis
5.4 Preparation of bill of quantities
5.5 Purpose, types and importance of specification
5.6 Purpose, principles and methods of valuation

6. Drawing Techniques

6.1 Drawing sheet composition and its essential components
6.2 Suitable scales, site plans, preliminary drawings, working drawings etc
6.3 Theory of projection drawing: perspective, orthographic and axonometric projection; first and third angle projection
6.4 Drafting tools and equipments
6.5 Drafting conventions and symbols
6.6 Topographic, electrical, plumbing and structural drawings
6.7 Techniques of free hand drawing

7. Engineering Survey

7.1 Introduction and basic principles
7.2 Linear measurements: techniques; chain, tape, ranging rods and arrows; representation of measurement and common scales; sources of errors; effect of

slope and slope correction; correction for chain and tape measurements; Abney level and clinometers

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

7.4 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; methods of contouring

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

7.6 Uses of Total Station and Electronic Distance Measuring Instruments,GPS, GIS

8. Engineering Economics

8.1 Demand and supply, economic equilibrium, Cost classification, interest and time value of money; payback period, net present value, internal rate of return, benefit cost analysis, risk analysis, financial and economic evaluation.

9. Professional Practices

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

9.2 Nepal Engineering Council Act, 2055 and regulations, 2056

9.3 Water Resourses Act, 2049

9.4 Relation with clients, contractor and fellow professionals

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

काठमाडौं उपत्यका खानेपानी लिमिटेड

प्राबिधिक सेवा, सिभिल समूह, ७ तह, इन्जिनियर पदको खुल्ला तथा समाबेशी र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

द्वितीय पत्र : Water Supply and Sanitary Engineering and Environment र KUKL सम्बन्धि

1. Section A: Water Supply Engineering [2X10=20 and 4x5=20]

1.1. Introduction

1.1.1. Importance and necessity of Water Supply Scheme
1.1.2. Importance and Reliability of Water Works
1.1.3. Essentials of Water Supply Engineering

1.2. Water Demands

1.1.1. Various Types of Water Demands
1.1.2. The Per capita Demand
1.1.3. Factor affecting Per Capita Demand
1.1.4. Variation in Demand
1.1.5. Design periods
1.1.6. Population Data and Population Growth and Population Forecasting Methods

1.3. General Hydrology

1.3.1. Hydrological cycle
1.3.2. Precipitation and Type of Precipitation
1.3.3. Rainfall and its Distribution
1.3.4. Run-off and Estimation of Run-off
1.3.5. Evaporation Losses from Water Sources
1.3.6. Determination of Evaporation Losses
1.3.7. Percolation Losses
1.3.8. Losses due to Transpiration

1.4. Source of Water

1.4.1. Surface source: Lakes, Streams, Rivers, Impounded Reservoirs, Stored rain water Cistern,
1.4.2. Waste water reclamation and sea waterGround Water source: Infiltration Galleries, Infiltration Wells, Springs, open well or dug well, Tube wells

1.5. Development of Ground Water

1.5.1. Occurrence of Ground Water
1.5.2. Geological Factors Governing the Occurrence of Ground Water
1.5.3. Zones of Underground Water
1.5.4. Movement of Ground Water and its Velocity
1.5.5. Coefficient of Permeability
1.5.6. Ground Water Yield
1.5.7. Aquifer and Their Types

1.5.8. Yield of Wells and Tube Wells
1.5.9. Spherical Flow in Wells
1.5.10. Interference among the Wells
1.5.11. Well loss and Specific Capacity of Wells and Well Design

1.6. **Intakes**
1.6.1. Factors governing the Location of an Intake
1.6.2. Types of Intakes: River Intake, Canal Intake, Reservoir Intake, Lake Intake and Intake Conduit.

1.7. **Conduits for Transporting Water**
1.7.1. Various Types of Conduits
1.7.2. Hydraulics of Flow and Design of Pressure Pipes as Gravity mains
1.7.3. Flow in Pipe System
1.7.3.1.1. Forces Acting on the Pressure Conduits
1.7.4. Various Types of Pressure pipes
1.7.5. Pipe Appurtenances

1.8. **Pumps for Lifting Water**
1.8.1. Types of Pumps
1.8.2. Factors affecting the selection of Pump
1.8.3. Efficiency of Pumps
1.8.4. Economical diameter of the Pumping Mains

1.9. **Quality of Waster**
1.9.1. Characteristics of Water
1.9.2. Water borne Diseases and their Control
1.9.3. Water Quality Standards: WHO Standards, Nepal Standard

1.10. **Water pollution**
1.10.1. Introduction
1.10.2. Sources of Water Pollution
1.10.3. Types of Pollution
1.10.4. Preventive measures

1.11. **Water Treatment**
1.11.1. Objective of Treatment
1.11.2. Treatment Components: Screening, Plain Sedimentation, Sedimentation with Coagulation, Chemical used for Coagulation, Jar Test,
1.11.3. 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
1.11.4. Design of Sedimentation, slow Sand Filter, Rapid Sand Filter and Pressure Filter.

1.12. **Water Softening**
- 1.12.1. Method of Removing Temporary Hardness
- 1.12.2. Method of Removing Permanent Hardness

1.13. **Disinfection of Water**
- 1.13.1. Method of disinfection.
- 1.13.2. Chlorination and Disinfecting Action of Chlorine
- 1.13.3. Various forms in which Chlorine can be applied
- 1.13.4. Types of Chlorination, Break point Chlorination
- 1.13.5. Testing of Chlorine Residuals

1.14. **Distribution Syste**m
- 1.14.1. Layout of Distribution Networks
- 1.14.2. Method of Distribution
- 1.14.3. Pressure in Distribution System and System of Supply
- 1.14.4. Function and Types of Distribution Reservoir
- 1.14.5. Storage capacity, Location and Height of Distribution Reservoir
- 1.14.6. Wastage and Leakage of Water in Distribution System
- 1.14.7. Design of Distribution Networks

1.15. **Appurtenances in the Distribution system**
- 1.15.1. Fire Hydrants
- 1.15.2. Water Meters

1.16. **Operation and Maintenance of Water Supply System**
- 1.16.1. Definition of Operation and Maintenance
- 1.16.2. Difference between Maintenance and rehabilitation

2. Section B: Sanitary Engineering [2X10=20 and 4x5=20]

2.1. **Introduction**
- 2.1.1. Importance of Waste Water and solid waste management
- 2.1.2. Meaning and objective of Sewage Disposal
- 2.1.3. System of Collection: conservancy System and Water carriage system
- 2.1.4. Types of Sewerage System
- 2.1.5. National Standards of waste water effluent disposal.

2.2. **Quantity of Waste Water**
- 2.2.1. Source of Sanitary Sewage
- 2.2.2. Factors Affecting Sanitary sewage
- 2.2.3. Determination of Quantity of Sanitary Sewage

2.3. **Quantity of Storm Sewage**

2.3.1. Factors Affecting Storm sewage

2.3.2. Determination of Quantity of Storm-Water: Rational Method and Empirical Formulae Method

2.4. **Design of Sewers**

2.4.1. Introduction

2.4.2. Hydraulic Formulae for design of Sewers

2.4.3. Minimum Velocity of flow in sewers- Self cleaning

2.4.4. Maximum Velocity of Flow in sewers

2.4.5. Effect of variation in Flow of Sewage on Velocity of Flow in Sewers

2.5. **Construction of Sewers**

2.5.1. Factors Affecting the selection of Material for sewer Construction

2.5.2. Materials for Sewers, Joint in Sewers and Shape of Sewers

2.5.3. Structural Design of Sewers

2.5.4. Construction of Sewers: Excavation, laying, jointing and testing of sewers

2.5.5. Maintenance, Cleaning and Ventilation of sewers.

2.6. **Sewers Appurtenances**

2.6.1. Inlets, Catch Basins, Clean-Outs, manholes, Lamp-Holes, Flushing Devices Grease and Oil Traps, Inverted Siphons and Storm Water Overflow Devices

2.7. **Sewage Treatment**

2.7.1. Objective of Treatment, Treatment method: Physical, Chemical and Biologica

2.7.2. Preliminary Treatment of Sewage: screening-Screens, Grit Chambers, Sedimentation and Chemical Aided sedimentation Tank

2.7.3 Biological Treatment of Sewage:

2.7.3.1 Classification of Biological Treatment process

2.7.3.2 Activated sludge Process

2.7.3.4 Types of Activated Sludge Process

2.7.3.4 Method of Aeration in activated Sludge Process

2.7.4 Sewage Filtration

2.7.4.1 Types of sewage Filters

2.7.4.2 Construction and design of Standard Trickling Filters, High Rate Trickling Filter and Bio-Filters

2.7.5 Miscellaneous method

2.7.5.1 Oxidation Ditch, Oxidation Ponds, Aerobic Ponds Anaerobic Ponds Aerated Lagoons

2.8 Sewage Disposal

2.8.1 Sludge Treatment Process

2.8.2 Characteristics and quantity of Sludge

2.8.3 Sludge Thickening

2.8.4 Sludge Digestion, Sludge conditioning, sludge Dewatering

2.8.5 Final Disposal of Sludge

काठमाडौं उपत्यका खानेपानी लिमिटेड

प्राबिधिक सेवा, सिभिल समूह, ७ तह, इन्जिनियर पदको खुल्ला तथा समाबेशी र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

2.9 Onsite Disposal Method

2.9.1 Pit privy, Bore-hole privy Septic tank, Leaching Cesspools,

2.9.2 Septic Tank Sludge – transportation, treatments, disposal of effluent and sludge

3. Section C: Environment [10X1=10]

3.1 Introduction of Water pollutants, its causes, impact and remedial measures

3.2 Human excreta and its characteristics, pollution caused by excreta, health aspects Water supply and sanitation.

3.3 Solid waste management

- 3.3.1 Types and characteristics of solid waste
- 3.3.2 Garbage collection and disposal
- 3.3.3 **Method of solid waste disposal: dumping, sanitary land fill,** incineration and composting

3.4 Concept of Environmental Assessment

- 3.4.1 Initial Environmental Examination (IEE)
- 3.4.2 Environmental Impact Assessment (EIA)
- 3.4.3 Types of Environmental Impacts, and its mitigation measures.
- 3.4.4 Government rules and Regulation and procedures for EIA and IEE.

4. Section D: काठमाण्डौ उपत्यका खानेपानी लिमिटेड सम्बन्धी [5X2=10]

4.1 खानेपानी महशुल निर्धारण आयोग

4.2 काठमाण्डौ उपत्यका खानेपानी व्यबस्थापन बोर्ड

4.3 आयोजना कार्यान्वयन निर्देशनालय

4.4 काठमाण्डौ उपत्यका खानेपानी लिमिटेडको ऐतिहासिक पृष्ठभुमि र सागंठनिक संरचना

4.5 काठमाण्डौ उपत्यका खानेपानी लिमिटेडका प्रबन्धपत्र

4.6 काठमाण्डौ उपत्यका खानेपानी लिमिटेडका नियमावली

4.7 काठमाण्डौ उपत्यका खानेपानी लिमिटेडका सेयरधनीहरु बिचको सम्झौता

4.8 काठमाडौं उपत्यका खानेपानी लिमिटेड र काठमाण्डौ उपत्यका खानेपानी व्यबस्थापन बोर्ड वीचको Lease Agreement र अनुमति पत्र

4.9 कर्मचारी प्रशासन विनियमावली, २०६४

4.10 आर्थिक प्रशासन विनियमावली, २०६४