

काठमाडौं उपत्यका खानेपानी लिमिटेड

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

पाठ्यक्रमको रूपरेखा :- 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 इन्जिनियरिङ्ग 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 | - |

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ ।
- पाठ्यक्रमको प्रथम र द्वितीय पत्रको विषयवस्तु फरक फरक हुनेछन ।
- प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- प्रथम पत्रका पाठ्यक्रमका एकाईहरूबाट सोधिने प्रश्नहरूको संख्या निम्नानुसार हुनेछ । द्वितीय पत्रको पाठ्यक्रमका एकाईहरूबाट सोधिने प्रश्नहरूको 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 |
- वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको 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 ।
- बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
- विषयगत प्रश्नका लागि द्वितीय पत्रको विषयगत प्रश्नका लागि १० अङ्कका ५ ओटा लामो प्रश्न र ५ अङ्कका १० ओटा छोटो प्रश्न सोधिने छन ।
- द्वितीय पत्रमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन् । परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

काठमाडौं उपत्यका खानेपानी लिमिटेड

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

९. 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 सम्झन पर्दछ ।
१०. प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई 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

काठमाडौं उपत्यका खानेपानी लिमिटेड

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

- 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

काठमाडौं उपत्यका खानेपानी लिमिटेड

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

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 Resources 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

प्राविधिक सेवा, सिभिल समूह, ७ तह, इन्जिनियर पदको खुल्ला तथा समावेशी 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

काठमाडौं उपत्यका खानेपानी लिमिटेड

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

- 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.

काठमाडौं उपत्यका खानेपानी लिमिटेड

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

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 System**

- 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

काठमाडौं उपत्यका खानेपानी लिमिटेड

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

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 Biological
- 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

प्राविधिक सेवा, सिभिल समूह, ७ तह, इन्जिनियर पदको खुल्ला तथा समावेशी 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 व्यवस्थापन बोर्ड
- 4.3 आयोजना कार्यान्वयन निर्देशनालय
- 4.4 काठमाण्डौ उपत्यका खानेपानी लिमिटेडको ऐतिहासिक पृष्ठभूमि र सांगठनिक 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 व्यवस्थापन बोर्ड बीचको
Lease Agreement र अनुमति पत्र
- 4.9 कर्मचारी प्रशासन विनियमावली, २०६४
- 4.10 आर्थिक प्रशासन विनियमावली, २०६४