

## काठमाण्डौ उपत्यका खानेपानी लिमिटेड

प्राविधिक सेवा सिभिल समुह तह ७ ईन्जिनियर पदको

खुल्ला समावेशी तथा आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

१. लिखित परीक्षाको विषय, पूर्णाङ्क, प्रश्नसंख्या अंकभार र समय निम्नानुसार हुनेछ ।

पत्र	विषय	पूर्णाङ्क	उतिर्णाङ्क	खण्ड	परीक्षा प्रणाली	प्रश्न संख्या	प्रति प्रश्न अंकभार	समय
पत्र	सामान्य ज्ञान तथा सेवा सम्बन्धी सामान्य विषय	१००	४०	क) सामान्य ज्ञान	बस्तुगत बहु वैकल्पिक प्रश्न	१५	२	३ घण्टा
				(ख) बौद्धिक परीक्षण	बस्तुगत बहु वैकल्पिक प्रश्न	१०	२	
				(ग) सेवा सम्बन्धी सामान्य विषय	छोटो उत्तर आउने प्रश्न	१०	५	
द्वितीय पत्र	सेवा सम्बन्धी	१००	४०	विषयगत	लामो उत्तर आउने प्रश्न	१०	१०	३ घण्टा

२. द्वितीय चरण: अन्तर्वार्ताको योजना

विषय	पूर्णाङ्क	परीक्षा प्रणाली
व्यक्तिगत अन्तर्वार्ता	३०	मौखिक

३. प्रत्येक बस्तुगत प्रश्नमा चार वटा सम्भाव्य उत्तर दिइनेछ । जसमध्ये एउटा सही उत्तरमा (लोक सेवा आयोगले तोके बमोजिम) चिन्ह लगाउने वा लेख्नु पर्नेछ । प्रति गलत उत्तर वापत २० प्रतिशतका दरले अंक घटाइनेछ ।

४. प्रथम पत्र र द्वितीय पत्रको परीक्षा फरक फरक हुनेछ ।

५. दुवै पत्रको प्रत्येक खण्डको लागि फरक फरक उत्तरपुस्तिका प्रयोग गर्नुपर्नेछ ।

६. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी वा दुवै हुन सक्नेछ ।

७. प्रश्नहरू यथासम्भव सबै इकाईबाट पर्ने गरी र नेपालको सन्दर्भमा सोधिने छ । लामो उत्तर दिनुपर्ने प्रश्न एकै वा खण्ड खण्ड गरी (दुई वा सो भन्दा बढी) सोध्न सकिनेछ । यस्तो प्रश्न एक भन्दा बढी इकाईबाट पर्ने गरी सोध्न सकिनेछ ।

८. यस पाठ्यक्रममा जेसुकै लेखिएको भएता पनि पाठ्यक्रममा परेका ऐन, नियमहरू परीक्षाको मिति भन्दा ३ महिना अगाडी (संशोधन भएका वा संशोधन भई हटाइएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ ।

९. परीक्षामा कालो मसी भएको कलम वा डटपेन मात्र प्रयोग गर्नुपर्नेछ ।

१०. पाठ्यक्रम लागु मिति २०७८ श्रावण १ गते देखि ।

प्रथम पत्र: सामान्य ज्ञान र सामान्य बौद्धिक परीक्षण

प्रथमपत्र

(१०० अंक)

खण्ड (क) सामान्य ज्ञान र सामान्य बौद्धिक परीक्षण

१. सामान्य ज्ञान:

- क) नेपालको भुगोल र आर्थिक तथा सामाजिक क्रियाकलाप: धरातलीय स्वरूपको किसिम र विशेषता, नेपालमा पाइने हावापानीको किसिम र विशेषता, तालतलैया, खनिज पदार्थ, प्राकृतिक स्रोत साधन, यातायात, विद्युत, शिक्षा, स्वास्थ्य, संचार, कृषि, उद्योग, पर्यटन, र व्यापार सम्बन्धी जानकारी ।
- ख) नेपालको सामाजिक एवं सांस्कृतिक अवस्था: प्रथा, परम्परा, धर्म, जाजाति, भाषाभाषी, संस्कृति र साहित्य ।
- ग) राष्ट्रिय महत्वका समसामायिक घटना तथा नविनतम गतिविधिहरू खेलकुद, पुरस्कार, कला, साहित्य लगायत महत्वपूर्ण व्यक्तित्वहरू सम्बन्धी जानकारी
- घ) नेपालको संघीय, प्रादेशीक र स्थानीय संरचना तथा शासन प्रणाली सम्बन्धी जानकारी ।
- ङ) विश्वको भुगोल: महादेश, महासागर, अक्षांश, देशान्तर, अन्तराष्ट्रिय तिथि रेखा, समय, पर्वतश्रृंखला, नदी, हिमनदी, ताल र हिमताल ।

२. बौद्धिक परीक्षण:

२.१ Verbal and non-verbal aptitude-शाब्दिक/अशाब्दिक तार्किक परीक्षण:

Vocabulary, Alphabetical ordering of words, classification, Coding-Decoding, Insert the missing character, Direction and Distance sense test, Ranking order test, Relationship Test, Logical sequence of words Common Sense test, Assertion and Reason, Logical reasoning Figure series, Figure analogy, Figure Classification, Figure Matrix, Pattern completion/finding construction of squares and triangle, Analytical reasoning.

२.२ Numerical ability and Quantitative Aptitude-मात्रात्मक (संख्यात्मक/अंक सम्बन्धी) तार्किक

परीक्षण: Arithmetical reasoning, Insert the correct mathematical signs, Decimal and fraction, Percentage, Ratio, average, Profit and Loss, time and work.

खण्ड (ख) सेवा सम्बन्धी सामान्य विषय  
(Service Related General Issues)

(१) संविधान र ऐन, नियमहरू

- १.१ नेपालको संविधान
- १.२ आर्थिक प्रशासन विनियमावली, २०६४
- १.३ कर्मचारी प्रशासन विनियमावली, २०६४ (संशोधन सहित)
- १.४ कम्पनी ऐन, २०६३
- १.५ खानेपानी व्यवस्थापन बोर्ड ऐन, २०६३
- १.६ खानेपानी महशुल निर्धारण आयोग ऐन, २०६३
- १.७ सार्वजनिक खरिद ऐन, २०६३
- १.८ सार्वजनिक खरिद नियमावली, २०६४

- १.९ भ्रष्टाचार निवारण ऐन, २०५९
- १.१० खानेपानी सेवा संचालन सम्बन्धी निर्देशिका, २०६९
- १.११ खानेपानी तथा सरसफाई नीति २०७१
- १.१२ Ethics and professionalism: code of conduct and guidelines for professional engineering practices
- १.१३ Nepal Engineering Council Act, 2055 and regulations, 2056

## (२) काठमाण्डौ उपत्यका खानेपानी लिमिटेड सम्बन्धी

- २.१ काठमाण्डौ उपत्यका खानेपानी लिमिटेडको ऐतिहासिक पृष्ठभूमि तथा विद्यमान सांगठनिक संरचना ।
- २.२ सार्वजनिक नीजि साझेदारी (Public Private Partnership) को अवधारणा तथा सार्वजनिक नीजि साझेदारी । (Public Private Partnership) मा खानेपानी व्यवस्थापन भएका केही मुलुकहरूको संक्षिप्त जानकारी ।
- २.३ खानेपानी महशुल निर्धारण आयोग तथा काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन बोर्ड ।
- २.४ आयोजना कार्यान्वयन निर्देशनालय ।
- २.५ काठमाण्डौ उपत्यका खानेपानी लिमिटेडको प्रबन्धपत्र ।
- २.६ काठमाण्डौ उपत्यका खानेपानी लिमिटेडको नियमावली ।
- २.७ काठमाण्डौ उपत्यका खानेपानी लिमिटेडका शेयरधनीहरू बिचको सम्झौता तथा काठमाण्डौ उपत्यका खानेपानी लिमिटेड र काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन बोर्ड बीचको Lease Agreement र अनुमति पत्र ।
- २.८ काठमाण्डौ उपत्यका भित्रको खानेपानी व्यवस्थापन र चुनौती ।

## 3. Development

- 1.1 General Concept of Development Administration
- 1.2 Planning in Nepal: efforts, achievement and challenges
- 1.3 Sustainable Development & Sustainable Development Goal
- 1.4 Public Private Partnership

## 4. Social, Economic and Environmental Issues

- 2.1 Social Issues
- 2.2 Conflict Management
- 2.3 Social and Cultural Transformation
- 2.4 Diversity Management
- 2.5 Cyber Crime, Cartel ling, Monopoly, Terrorism, Corruption and Money Laundering
- 2.6 Eco System, climate change and carbon trade, Issues related to environment and protection.

## 5. Engineering Economics:

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.

## 6. Environment

- 6.1 Introduction of Water pollutants, its causes, impact and remedial measures
- 6.2 Human excreta and its characteristics, pollution caused by excreta, health aspects Water supply and sanitation.

### 6.3 Solid waste management

- 6.3.1 Types and characteristics of solid waste
- 6.3.2 Garbage collection and disposal
- 6.3.3 Method of solid waste disposal: dumping, sanitary land fill, incineration and composting

### 6.4 Concept of Environmental Assessment

- 6.4.1 Initial Environmental Examination (IEE)
- 6.4.2 Environmental Impact Assessment (EIA)
- 6.4.3 Types of Environmental Impacts, and its mitigation measures.
- 6.4.4 Government rules and Regulation and procedures for EIA and IEE.

प्राविधिक सेवा, सिभिल समुह तह-७ ईन्जिनियर पदको

द्वितीय पत्र: सेवा सम्बन्धी सामान्य बिषय

(१०० अंक)

## **General Civil Engineering**

### **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 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

## **Section B: Water Supply Engineering**

### **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**

- 1.2.1. Various Types of Water Demands
- 1.2.2. The Per capita Demand
- 1.2.3. Factor affecting Per Capita Demand
- 1.2.4. Variation in Demand
- 1.2.5. Design periods
- 1.2.6. 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 water Ground 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 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**

### **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 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

## **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