

प्रदेश लोक सेवा आयोग, कर्णाली प्रदेश

प्रदेश निजामती सेवा र स्थानीय सरकारी सेवाको प्राविधिकतर्फ इन्जिनियरिङ्ग सेवा, सिभिल समूह, जनरल, हाइवे, स्यानिटरी, इरिगेशन, हाइड्रोपावर र एयरपोर्ट उपसमूह, अधिकृतस्तर सातौं तह वा सो सरहको खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम र परीक्षा योजना

पाठ्यक्रमको रूपरेखा:- यस पाठ्यक्रम योजनालाई दुई चरणमा विभाजन गरिएको छ।

प्रथम चरण:-	लिखित परीक्षा (Written Examination)	पूर्णाङ्क:- २००
अन्तिम चरण:-	(क) सामूहिक परीक्षण (Group Test)	पूर्णाङ्क:- १०
	(ख) अन्तर्वार्ता (Interview)	पूर्णाङ्क:- ३०

**परीक्षा योजना (Examination Schedule)**

१. प्रथम चरण: लिखित परीक्षा (Written Examination)

पूर्णाङ्क: २००

पत्र	विषय	खण्ड	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्नसंख्या Xअङ्क	समय
प्रथम	General Subject	Part I: General Knowledge and General Ability Test	१००	४०	वस्तुगत (Objective): बहुवैकल्पिक प्रश्न (Multiple Choice Questions)	५०X१=५०	१ घण्टा ३०मिनेट
		Part II: General Technical Subject				५०X१=५०	
द्वितीय	Technical Subject		१००	४०	विषयगत (Subjective): छोटो उत्तर लामो उत्तर	१०X५=५० ५X१०=५०	३ घण्टा

२. अन्तिम चरण: सामूहिक परीक्षण (Group Test) र अन्तर्वार्ता (Interview)

पूर्णाङ्क: ४०

पत्र/विषय	पूर्णाङ्क	परीक्षा प्रणाली	समय
सामूहिक परीक्षण (Group Test)	१०	सामूहिक छलफल (Group Discussion)	३० मिनेट
अन्तर्वार्ता (Interview)	३०	बोर्ड अन्तर्वार्ता (Board Interview)	

**द्रष्टव्यः**

१. यस पाठ्यक्रमलाई प्रथम चरण र अन्तिम चरण (सामूहिक परीक्षण र अन्तर्वार्ता) मा विभाजन गरिएको छ ।
२. सिभिल समूहका उल्लेखित सबै उपसमूहको खुला र समावेशी समूहको एउटै प्रश्नपत्रको माध्यमबाट संयुक्त र एकीकृत परीक्षा सञ्चालन हुनेछ ।
३. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी वा नेपाली र अंग्रेजी दुवै हुनेछ ।
४. 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 ।
५. बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा क्याल्कुलेटर प्रयोग गर्न पाइने छैन ।
६. विषयगत प्रश्नहरूको हकमा तोकिएको अङ्कमा एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिनेछ ।
७. परीक्षामा सोधिने प्रश्नसंख्या, अङ्क र अङ्कभार यथासम्भव सम्बन्धित पत्र/विषयमा दिईए अनुसार हुनेछ ।
८. विषयगत प्रश्न हुने पत्र/विषयका प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तर पुस्तिकाहरू हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको उत्तर पुस्तिकामा लेख्नुपर्नेछ ।
९. यस पाठ्यक्रम अनुसारका पत्र/विषयका विषयवस्तुमा जुनसुकै कुरा लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगावै संशोधन भई कायम रहेका विषयवस्तुलाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ ।
१०. लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र अन्तिम चरणको सामूहिक परीक्षण र अन्तर्वार्तामा सम्मिलित गराइनेछ ।
११. लिखित परीक्षा, सामूहिक परीक्षण र अन्तर्वार्ताको कुल प्राप्ताङ्कको आधारमा अन्तिम परीक्षाफल प्रकाशित गरिनेछ ।
१२. पाठ्यक्रम लागू हुने मिति: २०७९।०५।२०

## प्रथम पत्र (Paper I): General Subject

### Part (I): - General Knowledge & General Ability Test (50 Marks)

1. **General Knowledge and Contemporary Issues** (25 ×1 Mark = 25 Marks)
  - 1.1 Physical, socio-cultural and economic geography and demography of Nepal
  - 1.2 Major natural resources of Nepal
  - 1.3 Geographical diversity, climatic conditions, livelihood and lifestyle of the people of Nepal
  - 1.4 Notable events and personalities, socio-economic and cultural conditions in modern history of Nepal
  - 1.5 Current periodic plan of Karnali Province and Nepal.
  - 1.6 Information on sustainable development, environment, pollution, climate change, biodiversity, science and technology
  - 1.7 Nepal's international affairs and general information on the UNO, SAARC & BIMSTEC
  - 1.8 The Constitution of Nepal
  - 1.9 Governance system and Government (Federal, Provincial and Local)
  - 1.10 Provisions of prevailing civil service act and regulation
  - 1.11 Functional scope of public services
  - 1.12 Public Service Charter
  - 1.13 Concept, objective and importance of public policy
  - 1.14 Fundamentals of management: planning, organizing, staffing, directing, controlling, coordinating, decision making, motivation and leadership
  - 1.15 Government planning, budgeting, accounting and public assets management system
  - 1.16 Major events and current affairs of national and international importance
2. **General Ability Test** (25 ×1 Mark = 25 Marks)
  - 2.1 **Verbal Ability Test** (8×1 Mark = 8 Marks)

Jumble words, Series, Analogy, Classification, Coding-Decoding, Matrix, Ranking Order Test, Direction and Distance Sense Test, Common Sense Test, Logical Reasoning, Assertion and Reason, Statement and Conclusions
  - 2.2 **Numerical Ability Test** (9×1 Mark = 9 Marks)

Series, Analogy, Classification, Coding, Arithmetical reasoning/operation, Percentage, Ratio, Average, Loss & Profit, Time & Work, Data interpretation & Data verification

**2.3 Non-verbal/Abstract Ability Test (8×1 Mark = 8 Marks)**

Figure Series, Figure Analogy, Figure Classification, Figure Matrix, Pattern Completion/Finding, Analytical Reasoning Test, Figure Formation and Analysis, Rule Detection, Water images, Mirror images, Cubes and Dice & Venn-diagram

**Part (II): - General Technical Subject (50 Marks)**

**1. Structural Engineering (5×1=5 marks)**

- 1.1 Center of gravity, moment of inertia, radius of gyration
- 1.2 Stresses and strains, theory of torsion and flexure
- 1.3 Analysis of beams, columns, slabs and frames: bending moment, shear force and deflection.
- 1.4 Determinate structure: Energy methods in structural analysis, suspension cable system
- 1.5 Indeterminate structures: slope deflection method and moment distribution method, use of influence line diagrams for simple beams, unit load method, two hinged arch, three hinged arch
- 1.6 Plastic analysis of beam and frame
- 1.7 Truss member force determination

**2. Engineering Survey (6×1=6 marks)**

- 2.1 Introduction and basic principles, classification of surveys
- 2.2 Linear measurement techniques: chain and tape method, 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
- 2.3 Compass: types of compasses, problems and sources of errors in compass survey
- 2.4 Plane table surveying: principles and methods of plane tabling

- 2.5 Leveling: principle of leveling, temporary and permanent adjustment of level, bench marks, booking methods and their recording, longitudinal and cross sectioning, reciprocal leveling, trigonometric leveling
- 2.6 Contouring: contour interval and characteristics of contours, methods of contouring, interpolation, use of contour map
- 2.7 Theodolite traversing: need of traverse and its significance, principle of traverse, computation of coordinates; adjustment of closed traverse and linked traverse, closing errors
- 2.8 Tacheometry: principle, tacheometric formula, relation of distance and elevation
- 2.9 Uses of total station and electronic distance measuring instruments
- 2.10 Curves: types and suitability, elements, geometry and setting out of curves (simple circular curve, vertical curve, transition curve)

**3. Construction Materials** **(7×1=7 marks)**

- 3.1 Properties of building materials: physical, chemical, constituents, thermal
- 3.2 Stones: characteristics and requirements of stones as a building material
- 3.3 Ceramic materials: ceramic tiles, mosaic tile, brick types and testing
- 3.4 Cementing materials: types and properties of lime and cement; cement mortar tests
- 3.5 Metals: types and properties of steel, alloys
- 3.6 Timber and wood: timber trees in Nepal, types and properties of wood
- 3.7 Miscellaneous materials: asphaltic materials (asphalt, bitumen and tar), paints and varnishes, polymers
- 3.8 Soil properties and its parameters
- 3.9 Local and modern building construction material in Nepal
- 3.10 New construction technologies: Geo-grid, Geo-textile, Prefab, Reinforced wall and similar types of construction materials

**4. Concrete Technology** **(5×1=5 marks)**

- 4.1 Constituents and properties of concrete (physical and chemical)
- 4.2 Water cement ratio
- 4.3 Grade and strength of concrete, concrete mix design, testing of concrete
- 4.4 Mixing, transportation pouring and curing of concrete
- 4.5 Admixtures
- 4.6 High strength concrete, Self-Compacting Concrete
- 4.7 Pre-stressed concrete

#### 4.8 Underwater Concreting Techniques

### **5. Geotechnical Engineering** **(6×1=6 marks)**

- 5.1 Formation of soil, general classification of soil depending on transporting agent and deposit media
- 5.2 Three phases of soil: basic terms, relation between basic terms, volumetric relationship: mass and volume, weight and volume, specific gravity of soil and laboratory test, field density and determination methods
- 5.3 Types of water in soil, moisture content and relationship, organic content in soil
- 5.4 Index properties of soil: grain size distribution and types of soil depending on grain size distribution, consistency limit, relative density, laboratory test of index properties
- 5.5 Types of rock, dip, strike, fold, fault, cleavage, geographical divisions of Nepal,
- 5.6 Earthquake: causes of earthquake, types of waves, grading of earthquake, seismic fault line in Nepal
- 5.7 Tunnel: types of tunnels, components and method of tunneling.
- 5.8 Soil stabilization technologies

### **6. Public Procurement and Construction Management** **(6×1=6 marks)**

- 6.1 Types of Bidding and types of contract
- 6.2 Need assessment for public procurement
- 6.3 Bid Evaluation and Qualification Criteria
- 6.4 Price adjustment coefficient range calculation
- 6.5 Bid Evaluation and signing of contract
- 6.6 Framework Contract
- 6.7 Construction scheduling and planning: network techniques (CPM, PERT) and bar charts
- 6.8 Cost, quality and time control
- 6.9 Occupational health and safety, Provision of Insurance
- 6.10 Project monitoring and evaluation
- 6.11 Quality assurance plan, Total Quality Management
- 6.12 Extension of time, price adjustment, Variation Order, Dispute resolution.
- 6.13 Taking over, DLP management, Final account settlement

**7. Specification, Estimating, Costing and Valuation** (5×1=5 marks)

- 7.1 Types of estimates and their specific uses
- 7.2 Methods of calculating quantities
- 7.3 Key components of estimating norms and rate analysis
- 7.4 Preparation of bill of quantities
- 7.5 Purpose, types and importance of specification
- 7.6 Purpose, principles and methods of valuation
- 7.7 Lump sum, Provisional Sum Items

**8. Engineering drawing** (4×1=4 marks)

- 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 Drafting tools and equipments
- 8.5 Drafting conventions and symbols
- 8.6 Topographic, electrical, plumbing and structural drawings
- 8.7 Techniques of free hand drawing
- 8.8 Public and Community buildings and their architectural design considerations

**9. Engineering Economics** (3×1=3 marks)

- 9.1 Benefit cost analysis, cost classification, sensitivity analysis, internal rate of return, return on equity, discounted cash flow, time value of money; economic equilibrium, demand, supply and production, net present value, financial and economic evaluation

**10. Professional Practices** (3×1=3 marks)

- 10.1 Ethics, integrity and professionalism: code of conduct and guidelines for professional engineering practices
- 10.2 Nepal Engineering Council Act, 2055; and regulations, 2056
- 10.3 Relation with clients, contractor and fellow professionals
- 10.4 Public procurement practices for works, goods and services and its importance
- 10.5 National Building Code: Hierarchy of building codes and its application, procedure for implementation of building code in Nepal
- 10.6 Building Bylaws
- 10.7 Engineering Bylaws, rules and regulations

## द्वितीय पत्र (Paper II) : Technical Subject

### Section (A) - 5 Marks

#### 1. Building

- 1.1. Building: Definition, Knowledge on basic materials such as stone, bricks, hollow concrete blocks, sand, lime, mortar, cements, timber, steels, aluminum, flooring materials, doors and windows materials, roofing materials, plastering materials, painting, water proofing
- 1.2. Building elements: Basic knowledge on horizontal elements, vertical elements, function of each elements
- 1.3. Types of building structures: Basic knowledge on framed structures, load bearing structures, pre-fabricated structures and retrofitting
- 1.4. National Building Code (NBC): Requirement of earthquake resistant building construction, importance of NBC, provision on NBC, mandatory rule of thumb in building design

### Section (B) - 25 Marks

#### 2. Structural Engineering

- 2.1. Reinforced concrete structures: difference between working stress and limit state philosophy, design of beam and slab, 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
- 2.2. Steel: 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
- 2.3. Structural design of bridge: various types of bridges, selection and type of bridges and economic span length, types of loads, forces and stresses, live load, impact load, wind load, longitudinal forces, lateral loads, centrifugal force, earthquake effect consideration, width of roadway and foot way, general design requirements, solid slab bridges, deck-girder bridges, B.M. in slab supported on four edges, distribution of live loads on longitudinal beams, method of distribution coefficients, Courbon's method, design of a T- beam bridge, balanced cantilever bridge, design of prestressed simply supported bridge, design of box culvert, trail bridge: suspension and suspended

### **3. Geotechnical Engineering**

#### **3.1. Soil Mechanics**

##### **3.1.1. Identification and classification of soils**

Field identification of soils and soil classification: descriptive, textural, ISI, MIT and USCS

##### **3.1.2. Permeability of soils**

Factors affecting permeability of soil, determination of coefficient of permeability: laboratory and field methods

##### **3.1.3. Effective stress**

Factors affecting effective stress, capillary rise, quick sand condition

##### **3.1.4. Seepage analysis**

Flow net, application of flow net, seepage below concrete dam, sheet pile and safety check, seepage analysis through earthen dam and filter layer design, techniques to reduce discharge and to increase safety of dam

##### **3.1.5. Compaction of soil**

Concept of compaction, lab test, factors affecting compaction, specification of compaction, field control of compaction, methods of compaction in field and their suitability, special parameters to be considered for compaction in road, earthen dam

##### **3.1.6. Shear strength of soils**

Concept of shear strength, principal planes and principal stresses, Mohr-Coulomb theory of shear strength, calculation of normal stress and shear stress at different plane, relation of principle stress at failure condition, types of shear tests: direct shear test, unconfined compression test, triaxial test, vane shear test

##### **3.1.7. Consolidation and settlements**

Concept of consolidation, types of consolidation, test of consolidation, NC, OC, OCR, pre-consolidation pressure, calculation of settlement,

settlement of structures resting on soil: its nature, causes and remedial measures

### 3.1.8. Stability of slopes

Causes of slope failures, types of slope and slope failures, critical surfaces and factor of safety, method of stability analysis and stability number, bio-engineering: principles, concept, advantages, components and uses in stabilization of slope

## 3.2. Foundation Engineering

### 3.2.1. Introduction

Types of foundation, factors affecting on selection of foundation, requirement and criteria of ideal foundation, types of load for design of foundation, criteria for selection of depth of foundation

### 3.2.2. Earth pressure and retaining structures

Rankine's earth pressure theory, Coloumb's earth pressure theory, trial wedge theory, types of earth pressure, types of retaining wall, stability analysis of earth retaining structures, various techniques to increase stability of retaining wall

### 3.2.3. Bearing capacity and settlements

Types of bearing capacity of soil and factors influencing bearing capacity, effects of various factors on bearing capacity, modes of foundation failure, Terzaghi's general bearing capacity theory, ultimate bearing capacity of cohesionless and cohesive soils, settlement: types, nature and effects

### 3.2.4. Types of foundation and their suitability in the context of Nepal

Condition to use spread or strap or combined footing; mat: types, bearing capacity, construction approach, floating mat, compensating mat; pile: types, load carrying capacity, negative skin friction (NSF) and calculation; comparison between pile, pier, and caisson; caisson: types, bearing capacity, construction of well, tilt and shift of well and its retrofication and prevention

### 3.2.5. Design of foundation

Design of spread foundation, combined footing, strap footing, mat foundation, pile foundation, well foundation

### 3.2.6. Foundation stabilization, underpinning and geotechnical process

Soil stabilization, stone column, sand pile, dynamic deep compaction, grouting and its methods, methods of underpinning, methods of dewatering

## 3.3. Site Investigation and Soil Exploration

3.3.1. Purpose of site investigation, planning of investigation, stages of investigation, methods of boring, types of soil samples

3.3.2. In-situ test: standard penetration test, dynamic cone penetration test, correction of N value, calculation of bearing capacity using N value for isolated, mat, pile and well footing, plate load test, pile load test

3.3.3. Preparation of site investigation report

## **Section (C) - 25 Marks**

## **4. Water Resource Engineering**

### 4.1. Hydrology and Sediment

4.1.1. Rainfall measurements and related analysis

4.1.2. Flow measurements, rating curve and generation of flow data

4.1.3. Estimation of long term daily and monthly flows, low flows

4.1.4. Hydrograph analysis, synthetic unit hydrographs

4.1.5. Flood frequency analysis, estimation of design flood

4.1.6. Collection of sediment data, sediment rating curve, estimation of sediment yield and concentration, reservoir sedimentation

4.1.7. Ground water hydrology

### 4.2. Hydraulics

4.2.1. Fluid pressure, fluid kinematics, dynamics of flows

4.2.2. Boundary layers, uniform flow, steady flow, laminar and turbulent flow

4.2.3. Bernoulli's equation and its applications

- 4.2.4. Laminar and turbulent flow in open and close conduits
- 4.2.5. Concept of specific energy and gradually varied flows in open channel
- 4.2.6. Hydraulic jump and its types, flow profiles

#### 4.3. Irrigation

- 4.3.1. Function, advantages and disadvantages of irrigation; status and need of irrigation in Karnali Province and Nepal
- 4.3.2. Crops and soils, crop water and irrigation water requirements, water availability for irrigation
- 4.3.3. Irrigation methods (surface, sub-surface, sprinkler and drip), their suitability, advantages and disadvantages
- 4.3.4. Canal types, network and alignment, canal losses, command area, duty and delta
- 4.3.5. Silt theories, design of earthen and lined canals, canal standards, distinction between the irrigation in Terai and hills, specific considerations for hill irrigation
- 4.3.6. Design of irrigation structures on permeable foundation (seepage theories, piping & uplift)
- 4.3.7. Design of weir and barrage (crest, length and thickness of impervious floor)
- 4.3.8. Design of silt control structures (excluder, ejector and settling basin)
- 4.3.9. Design of energy dissipaters (hydraulic jump and stilling basins)
- 4.3.10. Design of river training works (guide bund, levees and spurs), watershed management
- 4.3.11. Design of regulators, drops, cross-drainage structures and outlets
- 4.3.12. Water logging (causes, effects and measures), design of surface and subsurface drainage
- 4.3.13. Planning and management of irrigation system in Nepal

#### 4.4. Hydropower

- 4.4.1. Hydropower development in Nepal, policy, acts and regulations
- 4.4.2. Types of hydropower projects (run-off river, peaking storage, and pump storage)
- 4.4.3. Flow duration curve, determination of reservoir capacity, reservoir sedimentation, useful life of reservoir

- 4.4.4. Power demand analysis and forecast
- 4.4.5. Potential and firm power, maximum power output, firm energy, surplus energy, seasonal energy, and average annual energy
- 4.4.6. Concept of load, load curve, capacity factor, load factor, and utilization factor
- 4.4.7. Power demand variation (hourly, daily, weekly, monthly, seasonal, and annual)
- 4.4.8. Layout of reservoir, diversion structures, de-sanding basin, water conveyance system, fore-bay, surge tank, penstock, power house, draft tube, headrace, tailrace, switch yard, and auxiliary structures
- 4.4.9. Dam classification and their usage based on functionality, acting forces, and construction material; selection of dam based on construction material, topography, economy and purposes
- 4.4.10. Concrete gravity dams: forces on gravity dams, their line of actions, stability against sliding, overturning, and floating
- 4.4.11. Embankment dams: earthen and rock-fill dams; basic design principles, concept of seepage through embankments, considerations in foundation and slope stability
- 4.4.12. Concept of coffer-dam and their usage
- 4.4.13. Design of spillways, types of spillway gates, location, and their functions
- 4.4.14. Energy dissipation methods, types of energy dissipaters, design of stilling basin and aprons
- 4.4.15. Design of intake, trash rack, gravel trap and approach canal
- 4.4.16. Types, location, and usage of de-sanding basin, suspended sediment characteristics, sediment velocities to be considered in de-sanding basin design, design of de-sanding basin, flushing of sediments from de-sanding basin
- 4.4.17. Hydraulic tunnels: pressure and non-pressure tunnels, tunnel cross-section and size, head loss in tunnels, concept of tunnel stability and protection measures, tunnel linings
- 4.4.18. Water hammer, hydro dynamic pressure calculations, design of fore-bay basin
- 4.4.19. Importance, location and application of penstock, anchor blocks and saddle support

4.4.20. Underground and surface power houses, power house dimensions and design, tailrace

4.4.21. Types and selection of turbines, concept of specific speed, gates and valves, draft tube, need and working principle of governors

## **Section (D) - 25 Marks**

### **5. Transportation Engineering**

#### 5.1. Highway engineering

##### 5.1.1. Highway Planning and Survey

Modes of transportation, Approach to road planning: establishing economic and environmental viability, evaluating alternatives, historical development of road construction in Nepal, classification of roads, national road network of Nepal, road survey and quantity calculation, process of identifying best route location, map study and reconnaissance survey, preliminary and detail survey, recommendation for best alignment, highway alignment and controlling factors, Asian Highway in Nepal and NRS 2070

##### 5.1.2. Geometric Design of Highway

Basic design control and criteria: design speed, vehicle characteristics, traffic volume & its composition, topography, elements of highway cross section, highway curves: type of curves, transition curves, reverse curves and their functions, circular curves, super elevation, stopping sight distance, vertical curves, gradients, average gradients and ruling gradient, Crest curve and sag curves, design considerations of horizontal and vertical alignment, extra widening, set back distance

##### 5.1.3. Evaluation of subgrade soil

Function of subgrade soil, CBR and its test, group index, plate load test, determination of modulus of subgrade reaction ( $k$ ), dynamic cone penetration test and its application

##### 5.1.4. Hill Roads

Hill road design: speed, sight distance, geological conditions and alignment selection criteria, gradient selection, Hair Pin Bends, horizontal curves, passing lane in hill roads, design of retaining and slope protection structures in hill roads, use of bio-engineering, drainage structures, stability of formation width and cut and fill slopes, mass haul diagram

#### 5.1.5. Highway Drainage

Importance of highway drainage: surface drainage and estimation of water quantity, design of drainage structures, erosion control and dissipating structures, subsurface drainage, cross drainage structures and types

#### 5.1.6. Highway Materials

Binding materials, types of aggregate and tests on their gradation, strength, durability, mathematical and graphical method of aggregate gradation, binding materials, bitumen, road tar, different type of viscosity grade of bitumen and its selection, penetration test, consistency tests, flash point test, composition tests, bituminous mixes and asphalt concrete, open and dense graded mixes, design of asphalt mixes,

#### 5.1.7. Traffic Engineering

Traffic engineering and scope, interrelationships between human/machinery/environmental elements, impact of human and vehicular characteristics on traffic planning, traffic operations and regulations driver and vehicle control, traffic control devices, traffic flow counts and speed studies, traffic flow characteristics, traffic count and presentation, origin and destination studies, parking studies, basics of road safety and accident study, dedicated lanes, basic requirements of intersections, types of intersections and configuration, channelized and non-channelized intersections, design of intersections, traffic signs, signals, road marking, road delineation, road lighting, factors influencing night visibility, design of the lighting system, traffic projection and forecasting

### 5.1.8. Road Pavement

Types of road pavements, flexible and rigid pavement, loads and other factors controlling pavement, design methods for flexible pavements, recent pavement design guideline for flexible pavement used in Nepal, stress due to load, temperature and subgrade friction, functions of pavement structure, axle load, damaging factor of axle loads, different types of pavement surfaces

### 5.1.9. Road Construction Technology

Activities and techniques used in road construction, tools, equipment and plants used in road construction, preparation of road subgrade, excavation, filling, compaction, moisture density relationship, field compaction control, soil stabilization, subgrade CBR improvement, application of geo-synthesis for pavement, Construction of asphalt concrete layers including prime coat, tack coat, and seal coat, construction procedure of penetration macadam, bituminous bound macadam, plain cement concrete pavements

### 5.1.10. Highway Maintenance, Repair and Rehabilitation

Classification of maintenance activities for on road and off road structures, inspection, prioritization and planning of maintenance operations, evaluation of pavement distress and pavement condition, types and methods of pavement repair, regular, recurrent, periodic and emergency maintenances, types of overlay and strengthening of existing pavements, road maintenance practices in Nepal.

### 5.1.11. Bridges: Trail bridges

## 5.2. Airport Engineering

### 5.2.1. Introduction

5.2.1.1. History of civil aviation in Nepal

5.2.1.2. Role and functions of Ministry of Culture, Tourism and Civil Aviation (MoCTCA) and Civil Aviation Authority of Nepal

5.2.1.3. Role of International Civil Aviation Organization (ICAO)

5.2.1.4. The economic, political, and social significances of airports

## 5.2.2. Airport Planning

- 5.2.2.1. Planning consideration: Airport and airport systems, airport system planning, airport master plan and strategic plan, information required, preliminary feasibility, factors affecting airport location, role of financing
- 5.2.2.2. Forecasting for planning purpose (Passenger, Aircraft, Cargo, Mail): Inventory and forecasting, factors affecting traffic growth, principles of forecasting, forecasting methods
- 5.2.2.3. Air side development: Physical characteristics runway, taxiway & apron, airport capacity and delay.
- 5.2.2.4. Landside development: Passenger terminal building and Terminal System, Design Considerations, apron-gate system, passenger processing, passenger amenities & baggage handling

## 5.2.3. Geometric Design of Aerodrome

- 5.2.3.1. Design of Runways: Definitions, aerodrome reference code, factors affecting the sitting, orientation and number of runway, factors affecting length of runway, actual length of runways, Turning pad runways with stop-ways and clearways, Runway end safety area (RESA), take-off length requirement, landing length requirement, physical characteristics of: runways, runway shoulders, runway strips, clearways, stopways, obstacle limitation surfaces
- 5.2.3.2. Design of taxiways, aprons and holding bays: functional requirements, taxiway width, taxiway curves, junction and intersection, rapid exit taxiways, passenger terminal apron, cargo terminal apron, size of apron, isolated parking bay, need of holding bays and bypasses, types of bypass, size and location of holding bays, marking and lighting of airport and its elements

## 5.2.4. Design of aerodrome pavement

Procedure for pavement design [Aircraft Classification Number (ACN), Pavement Classification Number (PCN) method], USA practices: design of flexible and rigid pavements.

#### 5.2.5. Visual aids for navigation

5.2.5.1 Operational factors, operating requirements, runway, taxi way and apron marking and lighting, airport signs.

#### 5.2.6. STOL Port and Heliport

5.2.6.1. STOL Port: Physical Characteristics of STOL Ports, importance of STOL Ports in the context of topography of Nepal and their role in the economic development of Nepal

5.2.6.2. Heliport: Physical Characteristics of Heliports

#### 5.2.7. Airport drainage

Purpose, determination run-off (FAA method), typical drainage layout, sub-surface drainage

### **Section (E) - 20 Marks**

## **6. Public Health Engineering**

### 6.1. Water Supply

#### 6.1.1. Introduction

Potable, contaminated and wholesome water, typical components of water supply schemes

#### 6.1.2. Sources of water

Various sources of water: surface sources, ground water source and rain water, ground water occurrences and prospecting, chemical characteristics and properties of ground water, recharge of ground water, ground water recovery, tube well design, selection of water sources.

#### 6.1.3. Quality of water

Types and sources of water pollution, effects of pollution (river, lake and reservoir), pollution of ground water, hardness of water, alkalinity in water, living organism in water, water borne diseases, physical, chemical and biological test of water, water quality standard: WHO standard and national drinking water quality standard, water safety plan.

#### 6.1.4. Quantity of water

Types of water demand, design period, methods of population forecasting, variation in demand of water, factors affecting demand of water

#### 6.1.5. Intake works

Site selection of an intake, Characteristics of various types of intake, various types of pumps including hand pump.

#### 6.1.6. Water treatment

Treatment systems: screening, plain sedimentation, sedimentation with coagulation, flocculation, filtration (Slow sand filtration/Rapid sand filtration), disinfection, softening, and miscellaneous treatments (aeration, removal of iron and manganese, removal of arsenic and color, odor and taste)

#### 6.1.7. Reservoirs and distribution systems

Types of reservoirs, sizing of reservoirs: mass curve method, peak demand method etc. reservoir design, water supply system: pumping system, gravity system, layout of the water supply system, pipeline design: design criteria, design of transmission and distribution system (including pipe networks)

#### 6.1.8. Operation and maintenance of water supply system

Difference between maintenance and rehabilitation, operation of water supply system, maintenance equipment: wrench

#### 6.1.9. Design of gravity flow water supply systems.

### 6.2. Sanitary Engineering

#### 6.2.1. Introduction

Importance of waste water and solid waste management, sanitation system, types of sewerage systems

#### 6.2.2. Quantity of waste water

Sources and nature of waste water, effluent characteristics, factors affecting sanitary sewage, determination of quantity of sanitary sewage, determination of quantity of storm water

#### 6.2.3. Characteristics and examination of sewage

6.2.4. Sampling of sewage, physical, chemical and biological characteristics of sewage, decomposition of sewage, aerobic and anaerobic decomposition, biochemical oxidation demand (BOD) and chemical oxidation demand(COD), test of solids, dissolved oxygen (DO), pH-value, BOD, COD, chlorine demand

#### 6.2.5. Design and construction of sewers

Typical design periods, flow velocity, self-cleaning velocity, flow diagrams, hydraulic formulae and gradients, estimation of quantity of sanitary sewage, collection systems, sewer design criteria, shape of sewers, types of sewers, sewer materials: requirements, salt glazed stoneware, and plain or reinforced cement concrete pipes, plastic, steel, brick, sanitary and storm water sewers for separate and combined sewer systems, construction of sewer: excavation, laying, jointing of sewer, testing of sewer, water test and air test

#### 6.2.6. Sewage treatment

Treatment methods, secondary treatment processes and their types, BOD removal, design criteria, activated sludge, oxidation ponds and ditches, aerated lagoons and lagoons, sewage filtration, intermittent sand filter, contact bed, trickling filters, bio- filters and design of trickling and bio-filters, design of septic tank and soak pit.

#### 6.2.7. Sewage disposal

Sewage disposal by dilution: essential conditions for dilution, self-purification of streams, factors affecting self-purification, the oxygen sag curve (Streeter-Phelps equation), sewage treatment by land treatment

#### 6.2.8. Sludge treatment and disposal

Sources of sludge and necessity of treatment, aerobic and anaerobic digestion, methods of sludge treatment: grinding and blending, thickening, stabilization, dewatering, drying, composting and incineration, methods of sludge disposal: spreading on land, lagooning, dumping and land filling

#### 6.2.9. Community participation and management

Users committee, village maintenance workers, training- pre-construction, during construction and post construction, women participation, GESI and community mobilization/participation, record keeping of water supply and sanitation project, rehabilitation, composting toilets, eco-sanitation

### 6.3.Environment

6.3.1. General introduction of air pollutants, its causes, impacts and remedial measures

6.3.2. Human excreta and its characteristics, pollution caused by excreta

6.3.3. Health aspects of water supply and sanitation

6.3.4. Green house effects, its impacts and remedial measures

6.3.5. Solid waste management, types and characteristics of solid waste

6.3.6. Garbage collection and disposal

6.3.7. Methods of solid waste disposal: dumping, sanitary landfill, incineration and composting

6.3.8. Concept of environmental assessment: Brief environmental study (BES), Initial environmental examination (IEE), Environmental impact assessment (EIA), Importance of environmental assessment, Types of environmental impacts, and EIA principles

6.3.9. Rules, regulations and procedures of federal and Karnali province government for environmental assessment.

6.3.10. Disaster risk reduction (DRR) and climate change impacts in infrastructure development projects.

## सामूहिक परीक्षण

सामूहिक परीक्षण व्यक्तित्व परीक्षणको एक अंश हो । प्रदेश निजामती सेवा र स्थानीय सरकारी सेवाको क्षेत्र विस्तार तथा कार्य पद्धति परिवर्तन समेत भैरहेको सन्दर्भमा कर्णाली प्रदेश सरकारको नीति, योजना, कार्यक्रम लगायत शासन व्यवस्था सम्बन्धी समसामयिक विषय माथि विचार-विमर्श, छलफल गरी तिनको अझै बढी प्रभावकारी तथा कार्यान्वयन योग्य समाधान पहिल्याउने सम्बन्धमा उम्मेदवारहरुको क्षमता पहिचान गर्नु यस परीक्षणको मूल मर्म हो । यसको लागि छलफल, विचार-विमर्श गरी परिस्थिति बुझ्न सक्ने, निर्णय दिने, जनतालाई क्रियाशील बनाउने, चित्त बुझाउने, निर्धारित लक्ष्य अनुसार काम गर्ने/गराउने, जस्ता कामका लागि लेखन क्षमताका साथसाथै समस्यालाई यथार्थपरक ढंगले पहिचान गर्नसक्ने, वाकपटुता, शिष्टता, तर्कशक्तिको पनि आवश्यकता पर्दछ ।

त्यसैले यस परीक्षणमा उम्मेदवारहरुको बौद्धिक क्षमता, संचार सीप, समूह गतिशिलता, व्यवहार, व्यक्तित्व, मनोवृत्ति, क्रियाशीलता, निर्णयशक्ति, समस्या समाधान क्षमता, नेतृत्व क्षमता, समय व्यवस्थापन तथा व्यक्तित्वमा भएका अन्य गुणहरुको आंकलन अर्थात परीक्षण र मूल्याङ्कन गर्नको लागि उम्मेदवारहरुलाई कुनै समसामयिक विषय/सवाल/समस्यामा सामूहिक छलफल गरी समस्या समाधान केन्द्रीत प्रभावकारी र कार्यान्वयन योग्य समाधान निकाल्न दिइन्छ ।

यस प्रयोजनको लागि गरिने परीक्षण १० पूर्णाङ्क र ३० मिनेट अवधिको हुनेछ जुन नेताविहिन सामूहिक छलफलको रूपमा अवलम्बन गरिनेछ । दिइएको प्रश्न वा Topic का विषयमा पालैपालोसँग निर्दिष्ट समयभित्र समूहबीच छलफल गर्दै प्रत्येक उम्मेदवारले व्यक्तिगत प्रस्तुति गर्नुपर्नेछ । यस परीक्षणमा मूल्याङ्कनको लागि देहाय अनुसार कम्तीमा तीन जनाको समिति रहनेछ ।

आयोगका अध्यक्ष वा अध्यक्षले तोकेको सदस्य	– अध्यक्ष
आयोगका सदस्य	– सदस्य
मनोविज्ञानवेत्ता	– सदस्य
दक्ष/विज्ञ (१ जना)	– सदस्य