द्वितीय पत्रः– हाइवे सम्बन्धी विषय

Section A- 30 Marks

1. **HIGHWAY ENGINEERING**

   1.1 Highway Planning and Survey 10%

   1.1.1 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

   1.1.1.1 Road survey and quantity calculation, haulage assessment of earthwork, use of mass curve in balancing earthwork and defining haulage range, process of identifying best route location, map study and reconnaissance survey, preliminary and detail survey, highway alignment and controlling factors,

   1.1.1.2 Asian Highway in Nepal and NRS –2045

   1.2 Geometric Design of Highway 10%

   1.2.1 Basic design control and criteria: design speed, design vehicle, traffic volume and its composition, topography etc., elements of highway cross section

   1.2.2 Highway curves: tangents, 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, recommendation for alignment for alignment design coordination of horizontal and vertical alignment

   1.3 Hill Roads (Sub unit 1.3, 1.4 and 1.5: 10%)

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

   1.4 Highway Drainage

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

   1.5 Highway Materials

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

Section B- 30 Marks

   1.6 Traffic Engineering 10%

   Traffic engineering and scope, interrelationships between human/machinery/ environmental elements, impact of human and vehicular characteristics on traffic planning, traffic operations and regulations covering driver control and vehicle

control, traffic control devices, traffic flow counts and speed studies, traffic flow characteristics studies, O and D studies, parking studies and accident study and analysis, Basic requirements of intersections, types of intersections and configuration, channelized and unchannelized intersections, design of intersections. importance of road lighting, factors influencing night visibility, design of the lighting system, traffic projection and forecasting

1.7 Road Pavement (Sub unit 1.7, 1.8 & 1.9: 20%)

Types of road pavements, flexible and rigid pavement, loads and other factors controlling pavement, design methods for flexible pavements, design methods for rigid pavements, stress due to load, temperature and sub-grade friction, function of pavement structure, axle load, damaging factor of axle loads, different types of pavement surface

1.8 Road Construction Technology

Activities and techniques used in road construction, tools, equipment and plants used in road construction, preparation of road subgrade, excavation, fill, compaction, moisture density relationship, field compaction control, soil stabilization, Construction of asphalt concrete layers including prime coat, tack coat, and seal coat, construction procedure of grouted macadam or penetration macadam, construction procedure of bituminous bound macadam, construction procedure of plain cement concrete pavements.

1.9 Highway Maintenance, Repair and Rehabilitation

Classification of maintenance activities for road pavement and road facilities, inspection, prioritization and planning of maintenance operations, evaluation of pavement distress and pavement condition, types and methods of pavement repair, types of overlay and strengthening of existing pavements.

Section C- 20 Marks

2. BRIDGE AND TUNNELLING

2.1 (1.10) Introduction to Bridge and Tunneling (Sub unit 2.1& 2.2: 10%)

Choice of location of bridge site, classification of bridges and components of parts of a bridge, Hydraulic analysis of river, river bank and protection structures, Types of tunnels, component parts of a tunnel and tunnel cross section, survey for tunnel alignment, drainage, lighting and ventilation requirements for tunnels, method of tunneling in firm, soft soils and rock, tunnel lining

2.2 Structural analysis and design of bridge

2.2.1 Various types of bridges, selection of type of bridge and economic span length, types of loads, forces and stresses, live load, impact load, wind load, longitudinal forces, lateral loads, centrifugal force, width of roadway and footway, 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

2.2.2 Design of aqueduct

2.2.3 Design of box culvert

3. SOIL MECHANICS 10%

3.1 Properties of soils

3.1.1 Soil as a three phase diagram

3.1.2 Basic definitions of phase relationships

3.1.3 Index properties of soil
3.1.4 Determination of various index properties
3.2 Identification and classification of soils,
3.2.1 Field identification of soils
3.2.2 Soil classification: Descriptive, Textural, ISI, MIT and unified
3.3 Permeability of soils
3.3.1 Determination of the coefficient of permeability: laboratory and field methods
3.4 Shear strength of soils
3.4.1 Concept of shear strength
3.4.2 Principal planes and principal stresses
3.4.3 Mohr- Coulomb theory of shear strength
3.4.4 Mohr's stress circle and failure envelop
3.4.5 Types of shear tests
3.5 Stress distribution in soils
3.5.1 State of stress at a point in the subsoil
3.5.2 Stress from elastic theories
3.5.3 Boussinesq's theory of stress distribution
3.6 Consolidation and settlements
3.6.1 Behaviour of soil under compressive loads
3.6.2 Settlement of structures resting on soil: its nature, causes and remedial measures
3.6.3 Primary and secondary consolidation
3.6.4 Compressibility of soil
3.7 Stability of slopes
3.7.1 Causes of slope movements and failures
3.7.2 Types of slope and slope failures
3.7.3 Critical surfaces and factor of safety
3.7.4 Method of stability analysis and stability number
3.7.5 Use of Bio engineering in stabilizing slopes

Section D- 20 Marks

4. **FOUNDATION ENGINEERING**   **20%**
   4.1 Site investigation and soil exploration of bridge sites
   4.2 Earth pressure and retaining structures
   4.2.1 Rankine's earth pressure theory,
   4.2.2 Active and passive earth pressure on back fill,
   4.2.3 Stability analysis of an earth retaining structures
   4.3 Bearing capacity of soils
   4.3.1 Types of bearing capacity and factors influencing bearing capacity
   4.3.2 Effects of various factors on bearing capacity
   4.3.3 Modes of foundation failure
   4.3.4 Terzaghi's general bearing capacity theory
   4.3.5 Ultimate bearing capacity of cohesionless and cohesive soils
   4.4 Design of bridge foundation
   4.4.1 Design of spread foundation
   4.4.2 Design of mat foundation
   4.4.3 Pile foundation
   4.4.4 Pier foundation

4.4.5 Well foundation

4.4.6 Sheet piles and coffer dams

4.5 Foundation stabilization and underpinning

द्वितीय पत्रको एकाईहरुको प्रश्नसंख्या निम्नानुसार हुनेछ

द्वितीय पत्रका खण्ड	A			B		C		D
द्वितीय पत्रका एकाई	1.1	1.2	1.3,1.4,1.5	1.6	1.7,1.8, 1.9	2	3	4
प्रश्न संख्या	1	1	1	1	2	1	1	2

विषयगत नमूना प्रश्नहरु (Sample questions)

1. a) Discuss in detail the provision made in Nepal Road Standards (NRS) in respect of functional classification of road network in Nepal **(5)**

   b) Discuss in brief the different types of gradient you know **(5)**

2. a) Define transition curve. What are the objectives of providing transition curve in the horizontal alignment of a highway? Explain in brief. **(5)**

   b) The radius of a horizontal curve is 100 m. The design speeds is 50 Kmph. Assuming required data and calculate: **(5)**

   ii) the super elevation required if full lateral friction is to develop.

   ii) the co-efficient of friction needed if no super elevation is provided and equilibrium super elevation if the pressure on inner and outer wheel should be equal.

3. a) Discuss surface and sub-surface drainage of the highway drainage system **(3)**

   b) How do you define a hill road? Briefly describe the factors that are to be considered for hill road construction. **(4)**

   c) What do you know about bitumen emulsion and cutback bitumen? **(3)**

4. a) What do you mean by rotary intersection?. Discuss the advantages and limitations of traffic rotary intersections. **(5)**

   b) What are the causes of accidents? Discuss briefly the general principles that have been followed for the traffic safety of a city. **(5)**

5. a) Discuss the construction procedure for single or double bituminous surface dressing in brief. **(5)**

   b) What are the factors to be considered in the design of road pavement? Explain briefly **(5)**

6. a) What are the typical failures in flexible pavements?. Explain with sketches **(5)**

   b) Discuss what you know about river training structures applicable in the context of Nepal **(5)**

7. What are the assumptions of Rankine's theory? Derive the expressions for active and passive pressures. **(10)**

8. Discuss the situations where a well foundation is more suitable than the other types of foundation in bridge structures **(10)**

9. Derive an expression for the vertical stress due to a uniformly distributed load on a circular area using Boussinesq's theory. **(10)**

10. a) Differentiate primary consolidation and secondary consolidation. **(5)**

   b) What are the conditions to be satisfied when applying Courbon's theory of distribution of live load on longitudinal beams? Explain

लोक सेवा आयोग

नेपाल इन्जिनियरिङ्ग सेवा, सिभिल समूह, हाइवे उपसमूहको राजपत्राङ्कित तृतीय श्रेणी पदको खुला र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

नेपाल आर्थिक योजना तथा तथ्याङ्क, इन्जिनियरिङ्ग, कृषि, वन, विविध र शिक्षा सेवाका सबै समूह ⁄ उपसमूह,

राजपत्रांकित तृतीय श्रेणी र एवं स्वास्थ्य सेवाको सातौं र आठौं तहका पदहरुमा

प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र

लिइने **सामूहिक परीक्षण (Group Test)** को लागि

सामूहिक छलफल (Group Discussion)

यस प्रयोजनको लागि गरिने परीक्षण १० पूर्णाङ्क र ३० मिनेट अवधिको हुनेछ जुन नेताविहिन सामूहिक छलफल (Leaderless Group Discussion) को रुपमा अवलम्बन गरिने छ । दिइएको प्रश्न वा Topic का विषयमा पालैपालोसँग निर्दिष्ट समयभित्र समूहवीच छलफल गर्दै प्रत्येक उम्मेदवारले व्यक्तिगत प्रस्तुति (Individual Presentation) गर्नु पर्नेछ । यस परीक्षणमा मूल्याङ्कनको लागि देहाय अनुसारको ३ जना भन्दा बढीको समिति रहनेछ ।

आयोगका सदस्य	-	अध्यक्ष
आयोगका सदस्य	-	सदस्य
मनोविज्ञ	-	सदस्य
दक्ष ⁄ विज्ञ (१ जना)	-	सदस्य

सामूहिक छलफलमा दिइने नमुना प्रश्न वा Topic

उदाहरणको लागि - उर्जा संकट, गरीबी निवारण, स्वास्थ्य बीमा, खाद्य सुरक्षा, प्रतिभा पलायन जस्ता Topics मध्ये कुनै एक Topic मात्र दिइनेछ ।