MODEL SET 1

लोक सेवा आयोग

नेपाल इन्जिनियरिङ सेवा, सिभिल समूह अन्तर्गत हाइवे, स्यानिटरी र हाइड्रोपावर उपसमूह,

राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

Section A

1. Do you agree that the limit state method is more preferred in RCC structure design over the working stress method ? If so ,why this method is preferred ? give reasons . Give two advantages of working stress method . [3+2]
2. Compute the intensities of active and passive earth pressure at depth of a meters in dry cohesionless sand an angle of interval fiction of 30 and unit weight of 1.8tm. What will be intensities of active and passive earth pressure if the water level rises to the ground level ? take saturated unit weight of sand as 2.2 t/m .[5]
3. What do you mean by structural design of a bridge? List out the basic bridge components. Write down the stepwise procedure for the structural design of a RCC T-beam bridge girder of 18 m length. [2+1+7]
4. Explain the basic requirements for earthquake resistant building construction . Discuss the role of redundancy and ductility in seismic design . [6+4]

Section B

5. Despite the huge potential of horticulture and vegetable farming in the mild-hills cannot be achieved due to shortage of irrigation, please suggest the appropriate methods of irrigation system to be adopted. Can it be tied with reservoir hydropower projects? [5+5]
6. Mention some differences between geological and geotechnical investigation works that have to be carried out during field investigation of any hydropower project. [5]
7. How can we estimate groundwater storage potential in an aquifer? Describe and illustrate with appropriate examples the key concept of unsaturated zone groundwater hydrology and key factors that control the water flow in unsaturated zone.[4+6=10]

Section C

8. Compare the rigid and flexible road pavement from various criteria. [10]
9. What is Airport Master Planning? Elaborate the types of activities involved in the master plan process.[3+7=10]
10. What are the requirements of intersection for safety and accommodation of mixed traffic .[5]

Section D

11. Differentiate between IEE and EIA. What are the various stages or process involved in carrying out IEE of a project ?[5+5]
12. Bagmati river is highly polluted in the Kathmandu valley due to various factors but it becomes clean and pollution free after flowing several Kilometers down to the Terai region and its water is being used for irrigation purpose. What is the name of such natural process and describe the theory with oxygen sag curve? [10]

THE END

MODEL SET 2

लोक सेवा आयोग

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राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

Section A

1. What are the types of failures seen in beam ? Explain briefly with neat sketch .[5]
2. Illustrate with sketches about the various classes of live loads used in design of vehicular bridge ? What other loads in addition to live load is essential to be considered while designing superstructure of Reinforced Concrete Bridges ? [10]
3. Determine the moment of resistance for rectangular section with: fck = 25 N/mm^2; f_y = 500 N/mm^2; Tension reinforcement = 3 Nos 16 mm, width of section = 300 mm; Depth of section = 350 mm; Assume suitable cover. [5]
4. Write down the typical earthquake safety measures mentioned in the Building Code? How should the safe management of waste water be ensured in Building codes? [10]

Section B

5. What is role of hydrological cycle in climatic stability ? Explain assumptions of unit hydrograph .[5]
6. What do you mean by screening and ranking of hydropower projects? Discuss its advantages and disadvantages. [10]
7. Explain the waterlogging. What are the causes of waterlogging? Discuss in detail the precautionary measures for waterlogging.[2+3+5]

Section C

8. What are the controlling factors for the selection of road alignment? And describe alignment selection criteria for hill road? [5+5]
9. What are the various factors to be considered in designing traffic islands? Briefly describe with figures, how the speed of vehicles in controlled by traffic islands at the intersection? [10]
10. Calculate the safe stopping sight distance for design speed of 50 kmph for the following:
    a) Two way traffic on a two lane road
    b) Two way traffic on a single lane road.(Assume: f: 0.37 and t: 2.5 seconds)[5]

Section D

11. The role of the government agencies has been transformed to the role of a facilitator from the provider of the system. How do you look at this statement in the context of sustainable development of water supply and sanitation sector?[10]
12. Define eco-sanitation. What can you suggest socio-economically poor village people of disposal septic tank effluent, whereas they are facing with their hand-to-mouth problems ? [5]
13. What is role of incineration in refuse disposal ? Compare it with dumping in terms of advantages and disadvantages .[5]

THE END

MODEL SET 3

लोक सेवा आयोग

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समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

Section A

1. **Define the terms** ,development length ,flexural bond and anchorage length . What is the role of development length in column design .[5]
2. Define soil compaction and consolidation. What are the factors affecting soil compaction ?[5]
3. The construction process in use of prestressed concrete is rapid ,though we use very less in Nepal .What may be the reason of not using such rapid technique ? How it can be made more adaptive to all local levels in Nepal . [10]
4. **What are the types** of foundation used in Nepal ? Write their suitability with disadvantages .[10]

Section B

5. Answer the following question. [5+5=10]
   a) How do you compare water hammer with tsunami? Provide freehand sketches of different types of surge tanks and label the components .
   b) Water stands on the upstream side of the gravity dam of triangular section up to the full height of 35 m. The base width of the dam is 26 m. The uplift pressure intensity 'K' may be assumed to be 0.5. Show that;
   i) No tension exists anywhere along the base of the dam
   ii) The dam is safe against sliding
   iii) The maximum compressive stress in the body of the dam is less than the allowable crushing stress of the material 11 kgf/cm^2
   iv) The dam is safe against overturning
   Take the coefficient of friction between base and the foundation as 0.75 and the unit weight of material of the dam as 2400 kgf/m^3.
6. What do you mean by Duty of Water? Explain the influence of several factors which affects duty and how duty of water can be improved. [5]
7. Write the differences between a weir and a barrage. The Koshi Barrage in Nepal often experiences sudden and excessive flooding during the monsoon season. What are the major reasons behind such flooding? Mention any measures that can ensure maximum safety and help minimize loss of life and property.[4+6]

Section C

8. What are major components of airport drainage system ? How runoff is determined ?Describe briefly about surface drainage system .[4+3+3]
9. What is a rotary intersection? What are the advantages and limitations of traffic rotary intersection ?[5]
10. Describe the factors to be considered in design of pavements. Explain about CBR method of flexible pavement design.[5+5]

Section D

11. Draw a schematic diagram of a Gravity flow water supply scheme and explain the function of each parts.[5]
12. Elaborate pour-flush toilet and VIP toilet with neat Sketches.[5]
13. What do you understand by community mobilization in infrastructure projects? How can it be utilized effectively in construction, operation and maintenance of rural water supply projects? [10]

THE END

MODEL SET 4

लोक सेवा आयोग

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समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

Section A

1. Explain the basic differences among the retaining wall design of gravity, cantilever and counter fort type wall. What will be the pressure exerted at base of height 'h' with half height of water table? Assume density of soil as 'γ'. [5+5=10]
2. List out the rule of thumbs for RCC Buildings without masonry infill.[10]
3. What are the methods of soil stabilization ? How this method is different from underpinning .[4+6]

Section B

4. Explain the different terms in the Bernoulli's Equation. What assumptions must be met for this equation to be applicable? How can it be applied in using a Pitot tube? [4+3+3]
5. What do you mean by River training works? Describe various types of river training works and protection works.[5]
6. If you have to develop a small hydropower project of capacity 10 MW in a cost effective manner in a remote area of Nepal, what are the stages of study that have to be undertaken before the construction start? Discuss it. [10]

Section C

7. What are the basic design controls and design criteria for roads in Nepal ? Also draw a neat sketch of typical cross section of road with pavement structures.[7+3]
8. What are the different causes of traffic accidents? Explain various measures that may be adopted to prevent accidents. [5]
9. What are the major attributes considered for selecting highway alignment? Discuss the importance of economic and environmental viability assessment on highway planning. [5+5]

Section D

10. What is the importance of water treatment ? Describe briefly about components of water supply system with neat sketch .[2+8]
11. The following observations were made on a sewage sample at 20°C.[5]
    BOD_5^{20c} = 290.50 mg/l
    BOD_1^{20c} = 56.15 mg/l
    Calculate rate reaction constant k and ultimate first stage BOD at 25°C.
12. As per environment protection Act/Environment protection Regulation of Government of Nepal discuss in the brief the criteria for conducting **IEE/EIA** for development projects.[10]

THE END

MODEL SET 5

लोक सेवा आयोग

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पत्र: द्वितीय **विषय: Technical Subject**

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Section A

1. What is pre-stressed concrete ? What are its advantages and disadvantages ? [5]
2. Describe triaxial test under different condition of draining and consolidation .How this test is unique in comparison to direct shear test ? [7+3]
3. In Gorkha earthquake 2072 , significant number of temples and monumental structures were severely damaged in Kathmandu Valley. As a structural engineer of LSMC , what would be your recommendation to improve the seismic strength of such temples and structures to prevent design in future earthquake ? Shall modem construction materials permitted to be used in repair sal restoration of such structures?[10]
4. List out different methods of soil improvement techniques. Explain in detail stone column and sand pile soil improvement techniques and their applicability. [5]

Section B

5. What are cross drainage structure ? Describe each with neat sketches . [10]
6. a) Define Froude Number.
   b) Estimate the tail water elevation required to form a hydraulic jump from the following data:
   *Spill way elevation =150 m
   *Elevation of energy line just U/S of spill way crest=152.5m
   *Elevation of horizontal apron =100 m
   *Coefficient of discharge= 0.68
   *Neglect the energy loss due to flow over spill way. [10]
7. Discuss the major energy sources at present in Nepal . Which is the most useful alternative source of energy for Nepal? Explain in brief. [5]

Section C

8. Describe types of bitumen used for a prime coat ,their selection and favorable condition for each type of bitumen . [5]
9. What do you mean by transport plus concept? Which agency in Nepal is adopting this concept? Why this concept is important in Nepalese mountainous and hilly made? Write down pros and cons of this concept.[10]
10. What is the design consideration for airport terminal area? Explain.[10]

Section D

11. Discuss the merits and demerits of river water source (Melamchi Khole) and ground water source (in Kathmandu valley) for water supply scheme in Kathmandu. [5]
12. Why are community mobilization and participation important? Define special role of women participation in WSP.
13. Analyze the problems and issues of **solid waste management** in urban area of Nepal. Give your suggestions for alleviating the problems.[7+3]

THE END

MODEL SET 6

लोक सेवा आयोग

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Section A

1. Compare Working stress method and limit state method with logics f choosing any method over other . [5]
2. A square footing is to be constructed at a depth of 3.6 m below ground level on a sandy clay for which the cohesion is 0.575 kg/cm² and the density is 1.73 g/cm³. The total load applied on the soil is 375 tones uniformly distributed over the area of contact. Find the size of the footing using a load factor of 3. Take the relevant values of the factors as Nc=10, Nq=4, Nγ=2.[10]
3. What do you understand by Pre-tensioning and Post tensioning in prestressed concrete bridges Explain the special features of prestressed concrete.[5]
4. Discuss the causes of slope failures. Explain the concept of bioengineering and its advantages in slope stabilization is Nepal's challenging terrains.[5]

Section B

5. In Nepalese context, draw your opening on comparative benefit of each Thermal, Hydro, Wind and solar power.[10]
6. Describe different methods of surface irrigation with their advantages and disadvantages.[10]
7. What is a Unit Hydrograph (UH) ? How do you estimate design flood using UH? Mention.[5]

Section C

8. What are main causes of traffic accidents in Kathmandu? What measures should be taken to mitigate them? [5]
9. Can you explain what the difference between a roadway, a highway, and a freeway? Write the categories of roads as provisioned on Nepal Roads Standard 2070? Explain the use of tunnels and high bridges in highways in Nepal. [3+4+3]
10. What are the factors affecting the sitting, orientation and number of runway, its length and surface treatment required while designing a runway of aerodrome? [10]

Section D

11. What are the different types of **sewerage system**? What see their advantage and disadvantage? Suggest which one is best suited for Kathmandu valley and why? Also list the logic behind your selection of the particular type of treatment.[10]
12. What are the merits and demerits of slow sand filter and rapid gravity filter? Please compare on the basis of suitability, design and operation. Also compare the conventional and step-aeration activated-sludge processes. [3+3+4]

THE END

MODEL SET 7

लोक सेवा आयोग

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Section A

1. Write down the typical earthquake safety measures mentioned in the Building Code? How should the safe management of waste water be ensured in Building codes?[5]
2. What is bearing capacity of soil? What are the factors that affect the bearing capacity? What are the different design types that are usually selected for shallow as well as deep foundations?[2+4+4]
3. What are the stability requirements for design of retaining walls? Explain with neat sketch.[10]
4. Give Courbon's assumption for cross girder in a bridge. Explain what is the conditions to be fulfilled, so that the assumption could be applied for the analysis. [5]

Section B

5. Describes techniques to measures suspended-sediment discharge. How do they differ in the evaluation of suspended sediment concentration? Calculate the suspended sediment discharge (in kilonewtons per day) for a suspended sediment concentration of 22,000 ppm and a flow of 155m/s. [5+5]
6. Name various type of irrigation methods. Describe in brief the advantage and disadvantage of each methods.[10]
7. Define flow duration curve of a river. Describe the role of flow discharge curve of a river in the hydraulic design of headworks and powerhouse structures. [5]

Section C

8. Briefly discuss the governing factors for calculating sight distance as per the Nepal Road Standard-2070. [5]
9. List the various geometric elements to be considered in highway design. Calculate the stopping sight distances on a graded highway for a design speed of 90 kmph. Reaction time is 2 secs and value of u is 0.35
   a) When grade is 3% descending,
   b) When grade is 3% ascending
   c) When road is flat Le. zero grade [4+6]
10. Draw a neat sketch of a typical aerodrome, showing taxiways, aprons and holding bays. Describe in brief the functions of these components.[10]

Section D

11. What do you mean by aquifers? What are its types? Derive an expression for obtaining discharge from a confined aquifer.[5]
12. Describe different stages in sludge digestion process briefly. What are the different factors affecting sludge digestion and how they are controlled? Do you think sludge disposal by laboring in case of Nepal is appropriate and why? [4+4+2]
13. Describe the process of initial environmental examination (IEE) of a municipal solid waste management project. [5]

THE END

MODEL SET 8

लोक सेवा आयोग

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पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. Briefly describe the design considerations for column. [5]
2. What are the roles of National Building Codes in Nepal? How does the code address the problem earthquake? How could the code be made effective?[10]
3. Explain in detail the factors that should be considered for ideal bridge site location and ideal bridge type for a particular location. [10]
4. Write short notes on factors affecting coefficient of permeability.[5]

Section B

5. How do you differentiate laminar, transitional and turbulent flow in open channel and pipe flow? Mention limitations of Bernoulli's equation. [4+1]
6. Differentiate between the pipe flow and open channel flow. A hydropower plant has a circular surge tank of diameter 15 m at end of 2 Km long tunnel having diameter 4 m. Five penstocks each of diameter 1.525 m and 400 m long are used. Friction factor for tunnel is 0.018 and penstock is 0.0 acoustic wave velocity in penstock is 1370 m/s. In steady state, head reservoir level is 450 m with discharge at 25 m^3/s. Compute the water hammer pressure for sudden up closure, maximum upsurge and down surge and time of oscillation.[10]
7. What do you mean by multipurpose projects ? What are merits and demerits of multipurpose projects ? [10]

Section C

8. Briefly discuss the challenges in hill road construction. [5]
9. Enlist the various types of bitumens and their quality tests. Explain CBR test and its importance in design of flexible pavement.[10]
10. What are the different construction equipment and plants used in airport construction? Describe about different factors affecting selection of construction equipment.[3+7=10]

Section D

11. Which of the water source is most suited for Kathmandu valley ? Justify your answer . [5]
12. Calculate the 5 day's 20°c BOD of a sewage of sample whose 5 days 30oBOD is 110 mg/ltr. Assume the deoxygenation constant at 20°,K 0.1 [5]
13. As EIA National Guidelines now it is mandatory to conduct EIA for significant roads in Nepal. How does it help environmental as well as the road network? Give a critical analysis.[10]

THE END

MODEL SET 9

लोक सेवा आयोग

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पत्र: द्वितीय **विषय: Technical Subject**

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Section A

1. What are the design consideration for beam to support cantilever projection of slab ? [5]
2. Explain the essential components of a Site Investigation Report (SIR) and analyze how each component influences the design, safety, and economic aspects of a civil engineering project. Support your answer with suitable examples.[10]
3. Mention the factors affecting compaction. [5]
4. Describe the advantages of providing closed box shape in hollow box Girder Bridge and show the arrangement of closed box shape girder through a free hand diagram. [10]

Section B

5. A canal has bed width of om, full supply depth 1.6m.bankwidth 2.5 m, cutting slope 1:1, filling slope 1:5:1 and free board 0.4 m. calculate balancing depth.[5]
6. Mention the design steps of a de-sanding basin for a river with high sediment load Discuss the factors that influence the sediment velocities and the methods used for flushing sediments from the de-sanding basins .[5+2+3]
7. Define specific speed, synchronous speed, run away speed, speed factor and design speed of turbine. [10]

Section C

8. Enumerate the various mean of transport. Describe the considerations that lead to selection of a particular type of transport. [10]
9. Draw highway intersection in detail and show the traffic directions.
   a) Four legged intersections. c)Channelized intersections
   b) Multi legged intersections d) Three legged intersections [10]
10. Why is selecting the runway length important in airport? Mention. What factors influence the length of a runway in airport design? State.[5]

Section D

11. Describe the different types of living organisms found in natural water. Explain their effects on water quality.[5]
12. The catchment area of the city is 200 hectares and its population density is 300/hector. The water supply cooperation supplied at the rate of 135 lpcd in the city. Calculate the quantity of sewage generation if the 85% of the water supplied is being collected as wastewater at the treatment plant. Assume the peak factor for water supply is 2. [5]
13. Defining Biochemical Oxygen Demand of waste water, explain a set of Primary and Secondary Treatment units to remove it.[10]

THE END

MODEL SET 10

लोक सेवा आयोग

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समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

Section A

1. What is the reason of providing reinforcement bars on the upper side of beam while designing cantilever beams? What is the purpose of designing double reinforced beams? [5]
2. Describe briefly the design procedure of a mat foundation using conventional of design .How do you determine linear water way for a bridge to be constructed in an alluvial plain? What will happen if the linear water way is not sufficient ?[5+3+2]
3. Discuss the various causes of slope movement and failure. Explain different ways of stabilizing slopes.[5]
4. What is compensated foundation ? What may be types of mat foundation that are being used in Nepal ? Describe briefly about each with neat sketches .

Section B

5. Enlist the various methods of discharge measurement in rivers. Briefly explain the way of developing stage-discharge and flow duration curves. [5]
6. Describe the factors, which should be considered in the construction of Hill irrigation canals. Also list the environmental aspects of hill irrigation. [10]
7. Explain the suitability, advantages and limitations of run-off river and peaking ROR storage hydropower projects with examples.[5+5]

Section C

8. What is mass haul diagram ? Write it's importance in road construction . Also , explain about it's characteristics . [5]
9. Define Traffic Engineering. A vehicle of weight 2 tonnes skids through a distance equal to 50 meter before colliding with another parked vehicle of weight 1 tonne. After collision, both the vehicles skid through a distance equal to 15 meters before stopping . If the weight of both vehicles are equal, compute the initial speed of moving vehicle. Take coefficient of friction as 0.4 [10]
10. Discuss the components and functions of Pavement Management System (PMS) in maintaining airport pavements. Write techniques for evaluating the structural strength of pavements. How do you assess runway surface conditions? Mention.[4+4+2=10]

Section D

11. List the various impurities present in surface water sources. What are their effects on human health? Describe the various components of water treatment plant generally used for purification of water from such sources.[10]
12. What is sewage sickness ? Describe the process of activated sludge process . [10]

THE END

MODEL SET 11

लोक सेवा आयोग

नेपाल इन्जिनियरिङ सेवा, सिभिल समूह अन्तर्गत हाइवे, स्यानिटरी र हाइड्रोपावर उपसमूह,

राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. Describe under reinforced, over reinforced and balanced RCC section.[5]
2. Design a combined footing for two columns 32 cmx 32 cm carrying load of 60,000 kg and 40 cm carrying load of 80,000 kg. The column are spaced at 3.4 m centers and the hearing capacity of soil is 15 tones/m² Calculate the depth of the footing, reinforcement required at transverse section and cantilevers.[10]
3. Write short notes on methods and equipment of soil compaction in civil infrastructures construction. [5]
4. Discuss the causes of slope failures. Explain the concept of bioengineering and its advantages and disadvantages in slope stabilization in Nepal's challenging terrains.[3+7]

Section B

5. Describe the procedures laid down in the guidelines on the implementation and management of water supply project, 2047 for the formation of water user's committee, also mention its duties and responsibilities.[10]
6. The following stream flow records are obtained from a gauging station.

Time (Hr.)	0	12	24	36	48	60	72	84	96
Q (cumec)	5	8	20	50	30	20	10	6	5

   Determine volume of flood run off, base flow, surface run off and peak flood.

7. What is a surge tank? Mention its functions. Also discuss with reasons the appropriate location for a surge tank. Present a sketch to clarify your answer. [5]

Section C

8. Define tack coat, **seal coat** and priming . Discuss the types of seal coat and process of their application. State in brief the classification of road maintenance activities in Nepal.[3+4+3]
9. Explain the post card methods of O and D surveys. Discuss the advantage and disadvantage of the methods? how are the road intersection planned? Enumerated the various traffic controls needed at an intersection. [10]
10. Describe briefly about International Civil Aviation Organization (ICAO)'s requirement for aerodrome design and operations.[5]

Section D

11. Why water treatment is necessary in water supply system? Explain the different methods of removal of iron and manganese in ground water that is common in Kathmandu Valley and in Terai region. [2+4+4]
12. What is lagooning ? Write its advantages and disadvantages . Also ,compare lagooning with dumping . [5+5]

THE END

MODEL SET 12

लोक सेवा आयोग

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राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. Write down the design steps for doubly reinforced beam section . [5]
2. What do you mean by economical span length of a bridge? Explain . What types of loads are required to be considered while designing a road bridge ? [3+7]
3. The time for a clay layer to achieve 99% consolidation is 10 years. What time would be required to achieve 99% consolidation if the layer were twice a thick, five times more permeable and three times more compressible ? [5]
4. Define active and passive earth pressure in soil. Derive an expression for active and passive earth pressure by Rankine's method. [10]

Section B

5. Describe the derivation of a unit hydrograph from a direct runoff hydrograph. Then show how you would transform it to a different duration.[10]
6. What factors should be considered while formulating an irrigation scheme ? What are the modes of irrigation? [5]
7. What do you mean by concrete gravity **dams**? With a neat sketch, show the different forces acting on it. How do you check the stability of dam against sliding and overturning? [2+3+5]

Section C

8. What is belt and road initiative program ? what may its advantages and disadvantages for Nepal ?[10]
9. What do you understand by low cost pavement? Explain application of ottaseal. [5]
10. What are the factors to consider in site selection of Airport? Discuss different types of maintenance operations for flexible pavements. [5+5]

Section D

11. Classify the sedimentation tasks. How can we increase the setting efficiency of particles? [5]
12. What is self-cleaning velocity and no-scouring velocity in a sewer? Why sewers are not designed to flow full? Design a sewer to serve a population of 36000, the daily per capita water supply allowance being 135 liters, of which 10% find its way into the sewer. The slope available for the sewer to be laid is 1 in 625 and the sewer should be designed to carry 4 times the dry weather flow when running full. What would be the velocity of flow in the sewer when running full? Assume n = 0.012 in Manning's formula? [10]
13. What do you understand by greenhouse effect ? What are its causes ? How it can be mitigated ?[5]

THE END

MODEL SET 13

लोक सेवा आयोग

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समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. Design a two way slab for a room having clear dimension 5mx4m. The superimposed load 200 kg/m² using M15 mix and Fe415. Assume corners of the slabs are not held down. [10]
2. What are the requirements of earthquake-resistant building construction? Describe. [5]
3. What do you mean by effective earth pressure ? What are the determining factors that effect the effective earth pressure of soil ? [10]
4. What are the advantages of well foundation over the other foundations? Write short notes on methods and equipment of soil compaction in civil infrastructures construction.[5]

Section B

5. The anneal peak discharge of a river follows the Gumbel's extremes value distribution with s mean of 10000m/s and a standard deviation of 3000m³/s . What is the probability that the annual peak discharge it more than 15000m3/s .What is the magnitude of the peak discharge with an exceedance probability of 0.1? [5]
6. When the first hydropower was commissioned in Nepal? describe hydropower development history in Nepal. Give list of electrical and mechanical equipment commonly installed in hydropower plant. [5+5]
7. What is rainwater harvesting? Although Nepal has the second-largest per-capita water availability in the world, the area of uncultivated barren land is increasing every year. Analyze the reasons behind this situation. As an engineer working for the Government of Nepal (GoN), propose practical measures to address this problem. [10]

Section C

8. Describe briefly the methodology used in the construction of gravel mads. Differentiate between surfaced dressing treatment and other seal construction. [5+5]
9. Explain the highway cross-section used in hilly roads . [10]
10. What is SSD and OSD ? How these two terms are related to each other ?[5]

Section D

11. What is mean by treatment of water and why it in necessary ? What do you mean dry flocculation? [5]
12. Compare the separate and combined sewer system. What is self-cleaning velocity and non-scouring velocity in sewer? Why sewers are not designed to full flow? [4+3+3]
13. Discuss in briefly how global warming is affecting water supply sector in Nepal and what will be the proper remedial measures? [5]

THE END

MODEL SET 14

लोक सेवा आयोग

नेपाल इन्जिनियरिङ सेवा, सिभिल समूह अन्तर्गत हाइवे, स्यानिटरी र हाइड्रोपावर उपसमूह,

राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. Write on design consideration of one way slab . [5]
2. Nepal lies in earthquake prone zone and we have faced severe earthquake recently. So, what do you suggest in designing and construction of earthquake resisting building in urban areas? [10]
3. What is flow net ? Write its uses . [5]
4. What are the main types of foundation used for bridges? Describe in detail about underpinning with an aim to stabilize foundations of a bridge ?[5+5]

Section B

5. What is boundary layer ? Describe the term Displacement thickness , momentum thickness and energy thickness . [5]
6. a)Write short notes on:
   i) Surface drainage and its application
   ii) Sub-surface drainage and its application
   iii) Drainage coefficient (D.C)
   b) determine the sins at the outlet of a 5 hectare drainage system, if the DC is 1 cm and tile grade is 0.03%, Assumes rigidity coefficient of the materials is 0.011. [5+5]
7. Assume that you are assigned with a responsibility of investigating a case of failure of a bridge immediately after its construction. What steps would you follow to investigate whether hydrology is a potential cause of the failure? Illustrate the steps with appropriate examples. Also, show a template of report (with notes on expected contents under different chapters/sub-chapters) of such investigation to submit to a higher authority.

Section C

8. A highway curve with a radius of 500 meters is designed for a design speed of 80 km/h. Calculate the required superelevation (banking) of the curve, assuming a coefficient of lateral friction (friction between tires and road surface) of 0.15.[10]
9. Why road maintenance is necessary? Describe different type of road maintenance. Explain the maintenance of the bituminous pavement. [10]
10. What factors to be considered while selecting a location for airport? List down the factors.[5]

Section D

11. Why aeration in used in water treatment plants? Is it more commonly made with ground water surface water and why? give reasons [5]
12. Explain Multiple tube fermentation technique . What are the water related disease ? Describe briefly .[4+6]
13. What is environmental impact statement ? Write about its importance for environment protection .[5]

THE END

MODEL SET 15

लोक सेवा आयोग

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समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. How do you differentiate between one way and two way slab . [10]
2. Draw a sketch of a T beam bridge and indicate its components.[5]
3. Define and differentiate between compaction and consolidation of soil mass. Write down assumptions for Terzaghi's one dimensional consolidation theory. [5+5]
4. Illustrate the types of slope failures with suitable sketches. A vertical cut is made in a clay deposit. [consider: c=30 KN/m², = 0, r = 16KN/m³ Fc- 1.00 and Sn=0.261]

Section B

5. What effect you foresee on hydrological cycle due to climate change? Suggest the ways and means it mitigating climate change effects on irrigation projects. [5]
6. What is field investigation for a hydropower project? Differentiate between geological and geotechnical investigations. Explain the step by step procedure to estimate probabilistic seismic intensity for target probability of exceedance in specified years at a hydropower project site. [10]
7. Explain various methods of reclamation of water logged areas? Explain the specific consideration to be provided for the design, operation and management of Hill Irrigation system. [4+6]

Section C

8. What are the basic factors which influence the visible dimension of a road ? what correction in required in horizontal curves in negotiate the speed and stability of vehicles?[10]
9. What are the general requirements of traffic control devices ?What are traffic island ?Briefly describe various types of traffics islands
10. List the sequence of layers and test requirements in the field to construct a flexible pavement of parallel taxiway.[2+3=5]

Section D

11. What are the major factors governing in the water demand and variation of water demand? Briefly describe in context of Nepal.[10]
12. List in details the physical biological and socio-economic baseline information that have to he collected during EIA study of a water supply project [10]

THE END

MODEL SET 16

लोक सेवा आयोग

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पत्र: द्वितीय **विषय: Technical Subject**

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Section A

1. Analyze the factors governing the choice of connection type for built-up members (e.g., compound columns or trusses).Use examples to compare their strength, failure modes, and practical applicability in Nepalese construction.[10]
2. What are the stability requirements for design of retaining walls? Explain with neat sketch.[10]
3. For a saturated soil, given w= 40% and G... 2.71, determine the saturated and dry weight of soil . A 5 m high retaining wall having angle of repose 30 degree, C-SKN/m² and unit weight 17.5 KN/m. Determine the active pressure on the wall
   a) Before the formation of crack
   b) After the formation of crack.[10]

Section B

4. It is said that user's participation is a must from planning state of an irrigation project for its mocen. explain? How do you proceed for the preparation and development of an irrigation project? Also mention the various types of survey to be conducted. [10]
5. Design a regime canal for a discharge of 15m3/sec with slit factor=1. Assumes a trapezoidal section having side slopes :1 (H:V) [5]
6. What are the major constraints in development of Hydropower in Nepal? What are your suggestions to overcome such constraints?[10]

Section C

7. What is the ESWL? Explain the concept in the determination of equivalent load . Distinguish between the full grouted and semi-grouted bituminous macadam.[10]
8. What are the design criteria for designing a rigid pavement in a highway construction? Elucidate. Specify the conditions where rigid pavement is applicable. [5]
9. What is pavement evaluation and why is it necessary? Explain briefly the pavement evaluation process. Describe the meaning of PCN 8O/R/V/N/T. [10]

Section D

10. Write short notes on
    a) Impounding reservoirs b) Break point chlorination c) Artesian well [5]
11. How the operation and maintenance of water supply and sewerage system can be improved ? Community based water supply and sewerage systems are feasible and sustainable in Nepal.Justify this statement.[10]
12. Describe about the sources of pollution in Nepal. How these sources can be controlled. [5]

THE END

MODEL SET 17

लोक सेवा आयोग

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राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

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Section A

1. Explain the difference between Working Stress Method (WSM) and Limit State Method (LSM).Based on these design philosophies, analyze how the choice of method influences the design of RC beams in terms of safety, serviceability, and economy. Support your answer with suitable examples. [10]
2. How construction of steel structure is advantageous over RCC construction ? Compare the pros and cons of these two types of construction . [5]
3. In context of Nepal , T beam bridges are adopted in most of cases . How it is advantageous to other bridges types and what can be other alternative and feasible bridge type to T beam bridge ?[10]
4. What are the seepage analysis ? How it helps to avoid the failure of dam ?[5]

Section B

5. What are the different methods of irrigation? Briefly explain their function and suitability.[10]
6. Describe in detail the procedures involved in flood frequency analysis using both statistical and graphical methods. Discuss how the choice of probability distribution (Gumbel, Log-Pearson Type III, etc.) affects the estimation of design flood for hydraulic structures. [10]
7. What is difference between the renewable and non-renewable energy? Also write down the advantages and disadvantages of solar energy, bio-gas and hydropower . [5]

Section C

8. How is implementation of bolsters help to stabilize the unstable slope? Describe with appropriate sketches the slope of implementation of bolster for purpose of stabilization of degraded slopes.[10]
9. What are the functions of highway drainage? List the data necessary to glean before deciding on the drainage system for a road . A bituminous mix has been prepared with 10% asphalt by weight of mixture. Assuming the specific gravity of asphalt to be 1 and that of void less specimen of the mixture to be 2.3, calculate the effective specific gravity of the aggregate.[10]
10. What factors to be considered while selecting a location for airport? List down the factors.[5]

Section D

11. What is self-clearing velocity and non-scouring velocity in a sewer? Why sewers are not designed to full flow?[5]
12. A village of Nepal with design year population of 500 has water demand of 65 liters/capita/day. The demand is to be met by a continuous system of supply from a spring source with a safe yield of 0.3 IPs. The consumption pattern of the village is as follows: Is a balancing reservoir necessary? Calculate the its capacity if necessary.[10]

Time (hr)	5:00-7:00	7:00-12 :00	12:00-17:00	17:00-19:00	19:00-5:00
Consumption pattern (%)	25	35	15	20	5

13. Explain the procedure for site selection permanent intake in ace when the water leveling fluctuating to large extent during dry and wet season.[5]

THE END

MODEL SET 18

लोक सेवा आयोग

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समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. A reinforced concrete simply supported beam is subjected to factored loads. Explain the step-by-step analytical procedure for determining its bending capacity .. [5]
2. The suspension bridge at Kagbeni recently collapsed, raising concerns about the geotechnical stability of the area. Discuss the possible geotechnical causes that may have contributed to the bridge failure. Propose appropriate preventive measures to avoid such failures in the future, and prepare a brief technical report outlining the identified causes and suitable rehabilitation methods.[10]
3. What forces should we consider while designing the retaining wall to stabilize the slope during road construction in hills Enumerate .[10]
4. What is the key difference between pre tensioning and post tensioning in beam .What are limitation of prestress concrete ?[5]

Section B

5. What do you mean by recharge of ground water? Why is it needed? Explain different methods for recharge of ground water. [3+3+4]
6. Explain the steps involved in developing a rainfall–runoff relationship using rainfall measurements and hydrological data. What are the major factors affecting its accuracy?[5]
7. Describe briefly about different types of field investigation required for hydro power project.[10]

Section C

8. What are the different components of hill road drainage system? Make a sketch for a typical drainage system of hill road . Describe the difference between bitumen and tar. Explain the tests on bituminous materials: penetration text and viscosity test.[10]
9. Give briefly how "traffic census" is conducted for estimating traffic volume for a given road. How are the road intersections planned? Enumerate the various traffic controls needed at an intersection.[10]
10. What are the facilities that may be required for the planning and design of the terminal building ?[5]

Section D

11. A village has designed year demand of water 25000 liters/day. The demand is met by a continuous system of supply from a spring source with measured of 0.45 Lps. The water consumption pattern of village is as follows.

Time (Hours)	5-7	7-12	12-17	17-19	19-5
Consumptions %	25	35	15	25	0

(a) Determine the balancing reservoir capacity for the village by using above data.
(b) Describe the problems and solution associated with Gravity and pumping gravity combined water supply system in Nepal ?[10]

12. Describe about the physical, the chemical and the biological characteristics of sewage.[5]
13. How can you related the technology development with environment and society ?[5]

THE END

MODEL SET 19

लोक सेवा आयोग

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पत्र: द्वितीय **विषय: Technical Subject**

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Section A

1. Introduce working stress and limit state philosophy for design of RCC structures. Compare both methods with logics for choosing any method over other. [5+5]
2. Define simply supported and cantilever beams. Derive maximum bending moment for the beams in uniformly loaded condition .[5]
3. Define principle planes and principal stresses. Write down the coulomb's failure theory . Describe the settlement of structure of soil. What in the difference between consolidation and compaction?[5+5]
4. What are the advantages of well foundation over the other foundations ? [5]

Section B

5. If you have to design an irrigation system to be totally maintained by local farmers after construction, what factors would you consider in deciding about lined and unlined section of the canal? Give technical and economical reasons and discuss. [10]
6. How can we classify turbines? Indicate their suitability for different ranges of heads and specific speeds. Also discuss other important factors that are considered in the selection of turbines.[10]
7. Define willing point explain crop-water requirements for crops paddy, wheat, maize and potato grown in the mahabharat region of Nepal [5]

Section C

8. Explain: Why design, construction and maintenance of hill road of Nepal need special consideration "What are the special points to be considered in the alignment of hill road?[10]
9. The radius of a horizontal highway curve is 450 m, super-elevation provided is 1 in 15 and the width of pavements carve is 75. if the rate of change of centrifugal acceleration is not to exceed 0.45 m/sec and the rate of introduction of supper elevation (about the inner edge of pavement) is not to exceed 1:150, design the length of horizontal transition curve for a design speed of 100km.ph.
10. How the roads are classified in Nepal? And which institutions are responsible for its development and maintenance ? What are the factors affecting the siting, orientation and number of runway, length and surface treatment .[5+5]

Section D

11. What are the different types of distribution service reservoir used in water supply project in Nepal? How its storage capacity is determined ?[5]
12. Explain the aerobic and anaerobic decomposition of sewage . Describe major key points of Environmental Protection Regulation 2077 . [4+6]
13. What is meant by onsite sanitation system? Design a septic tank for 200 users, rate of water supply 45 liters/capita day, detention period 24 hours and cleaning of sludge as per 5 years.[5]

THE END

MODEL SET 20

लोक सेवा आयोग

नेपाल इन्जिनियरिङ सेवा, सिभिल समूह अन्तर्गत हाइवे, स्यानिटरी र हाइड्रोपावर उपसमूह,

राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. What are the foundation conditions under which mat foundation is preferred ? What is pile group efficiency ? How is the bearing capacity of a pile group determined in cohesive soils?[5+2+3]
2. Prestressed concrete is modern invention in construction field . How this is suitable and feasible in context of Nepal ? [5]
3. Name different types of loads coming on the foundation of a super structure. How are foundations classified as? What are causes of foundations failures?[2+4+4]
4. What is meant by bridge responses ? Explain each in brief . [5]

Section B

5. What are the key steps in flood frequency analysis ? Explain how a design flood is determined using statistical methods .Explain the safety issues and measures to be taken into consideration while constructing a tunnel? [3+3+4]
6. What are the basic difference between kennedy and Darcy theory. Which theory is used in the design of canal systems in Nepal and why? For a channel to be regime briefly mention the condition that is to be adhered.[3+3+4]
7. How you fixed the height of dam for the particular site? What do you understand by trap efficiency of the reservoir?[5]

Section C

8. Explain the advantage and disadvantages of road transport . What do you mean by "Pavement Distress" Mention in tabular form, symptoms, causes and treatments of defects in bituminous surfacing of Nepal .[10]
9. What are the various tests that are used for assessing the suitability of road aggregates.[5]
10. According to the Civil Aviation Authority Act, 2053, write functions, duties and power of Civil Aviation Authority of Nepal. [10]

Section D

11. What are the important uses of water? What is the per capita average demand for a Nepali Town for different uses? Explain the impurities in water and the purification mechanism of water at household level in Nepal. (2+4+4)
12. Design a septic tank for a hotel of any school where 125 residential students are regularly living that school. Also design the soil absorption system for the disposal of the septic tank effluent the percolation rate as 20 minutes per cm.[5]
13. Explain the role of CO on green house effect .Why Initial Environmental Examination (IEE) is necessary for water supply project.

THE END

MODEL SET 21

लोक सेवा आयोग

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राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. Describe the analytical procedure for checking shear strength and deflection control in a reinforced concrete beam . Additionally, discuss how bond and end-anchorage requirements affect reinforcement detailing in such beams.[10]
2. Nepal lies in earthquake prone zone and we have faced severe earthquake recently . So, what do you suggest in designing and construction of earthquake resisting building in urban areas? [10]
3. What are the factors that affect permeability of soil . Explain in brief .[5]
4. Note the type of foundation employed in a building constructed recently in your area. List and explain briefly obvious reasons why this type of foundation was selected.[5]

Section B

5. Water flows in a horizontal channel with velocity of 6.0m's at depth of 1.2 m. Find the conjugate depth and the energy loss in the jump.[5]
6. Explain the process of hydrograph separation and describe how a synthetic unit hydrograph is developed for an ungauged catchment. List out the activities to carry out IEE and EIA studies. How do you assess the sediment load of a river? [5+5]
7. Classify the hydraulic jumps on the basis of Froude number . Explain the role of Ministry of Energy, NEA and DOED for developing of hydropower project in Nepal and state the importance of Electricity Act, 2049.[3+7]

Section C

8. What are the various systems **of classification of roads**? Briefly outline the classification based on location and function. Discuss in details the provision made in Nepal Road Standards (NRS) with respect to functional classification of Road Network of Nepal.[10]
9. Write down the urgency and importance of highway maintenance. Classify the inspection procedures for the same.[5]
10. If Civil Aviation Authority of Nepal (CAAN) appointed you as pavement engineer for review the design report of Runway of XYZ national Airport submitted by international consultant which going construction immediately after finalization of design. CAAN instructed you to check the runway which should be operated by B747 aircraft or equivalent (ICAO Code 4E). How can you start your assigned works and what types of element are you considered! Describe briefly.[10]

Section D

11. A water supply company has to purify the turbid water for a city whose daily demand is 200000 liters. Design a suitable plain sedimentation tank fitted with mechanical sludge remover. Assume the velocity of flow in the tank as 20 cm/minute and the detention time as 10 hours. [5]
12. What are types of latrines used in Nepal ? How these onsite sanitation methods enhance the ecological environment .Also , explain the design steps for VIP latrines . [5]
13. In context of scarcity of land fill sites, solid waste management has become difficult task in Kathmandu valley. What are your suggestions to reduce and recycle the wastes so that pressure on land fill site could he out down? Provide pragmatic solutions.[10]

THE END

MODEL SET 22

लोक सेवा आयोग

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राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

Section A

1. Describe the design of a well/caisson foundation: types of wells, forces acting (vertical, horizontal, uplift), sinking methods, lateral stability, scour considerations, and design steps.[5]
2. A retaining wall 6 m high retains a backfill with unit weight 19 kN/m³, angle of internal friction 28°, and the ground water table is at the base of the wall. Compute the active earth pressure diagram and total active thrust per meter length of wall using Coulomb's theory .[5]
3. Describe about improving techniques for earthquake resistance of tall buildings . Write mandatory rule of thumb for RCC building of two storey . [5+5]
4. Draw opinions on the merits and demerits T beam bridge and Box culvert . Why T beam bridge is more in practice in comparison to other type of bridge ? A bridge on the Araniko Highway experiences heavy lateral loads due to frequent landslides.[4+3+3]

Section B

5. What is permanent wilting point . Explain with neat diagram . Which type of irrigation system is best suited in context of Nepal ? Compare this method with others methods .[2+8]
6. What do you understand by hydrological forecasts and warnings? Describe the classification of hydrological forecasts and types of warnings .Design an irrigation canal of 15 m/s capacity, whose side slope coefficient and bed slope are 065 & 0.02% respectively with Manning's roughness coefficient of 9.023 so that its flow velocity could be lay it between non-silting and non-scouring value.[5+5]
7. Write the major parameters to decide the type of dam for storage project. What major load you consider while designing the concrete gravity dam? [5]

Section C

8. What are soil stabilized roads ? Describe in brief . Mention the factor that affect the mechanical stability of road . Also, Describe the role of bioengineering in such project . [7+3]
9. Describe the basic steps to be considered for the airport site selection. What are flexible and rigid pavements? Describe the with sketch. Which types of pavements is suitable for hill made in Nepal? Give reasons.[4+6]
10. What are the steps to considered during the preparation of a wearing course of a metaled highway.[5]

Section D

11. In the treatment of 25X10 m/day of water, the amount of chlorine used is 15 Kg/day. The residual chlorine after 10 min contact is 0.2 mg/ltr. Determine chlorine demand in mg/ltr.[5]
12. What is the principle behind an activated-sludge treatment plant? Explain with a neat flow diagram. Also compare the conventional and step-aeration activated-sludge processes. [3+3+4]
13. Compare sanitary landfilling and modern waste-to-energy incineration in terms of environmental impact. Which method is more suitable for Nepal's current waste scenario, and why? Provide justification.[5]

THE END

MODEL SET 23

लोक सेवा आयोग

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राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. Describe the codal requirement of reinforcement in detailing . How bar bending schedule assists site engineer in various stages of building construction . Also , Why built up drawing is mandatory for any structure ?[4+3+3]
2. What is quick sand condition ? Derive expression for it . Also, write about causes of such effect . [5]
3. Explain the concept of settlement of foundations — distinguish between immediate (elastic) settlement and consolidation settlement, derive the expression for one dimensional consolidation settlement, and apply to a clay layer of thickness 3 m with compression index Cc = 0.25 when effective stress increases from 100 kPa to 200 kPa .[5+5]
4. Explain with calculations how lateral earth pressure could affect the stability of the abutment and suggest mitigation measures.[5]

Section B

5. What are the advantages and disadvantages of ground water irrigation is compared to surface canal irrigation? A penstock pipe of internal diameter as 2 m is subjected to 100 m statistical head of water and 20% additional dynamic head of allowable stress of material is 120 N/mm determine the wall thickness of pipe assuming the joint efficiency as 90%.[5+5]
6. What are the steps for ideal dam site selection ? Describe suitability each type of dam .Describe with neat sketch how the storage volume of reservoir for the given rate of draft is fixed through mass curve analysis?[10]
7. Describe the procedure for constructing a rating curve for a river section. How is this rating curve used to convert stage measurements into discharge ? [5]

Section C

8. Describe in detail the construction procedure for single and double bituminous surface dressing as commonly practiced by the Department of Roads (DoR) in Nepal. In your answer, also explain cutback bitumen and bitumen emulsions and their suitability for Nepal's climatic and geographic conditions. Further, discuss the desirable properties of bituminous mixes and briefly describe the ductility test of bitumen along with its engineering significance in pavement performance.[4+3+3]
9. Explain the necessity of highway planning on Nepal. What are the uses of fact finding surveys? How are these used and interpreted?[5]
10. Make a survey team for detailed survey of the STOL airfield proposed in remote area of the country and make a list that it necessary to carry out the said survey, Also, explain the problems that may encounter in carrying out the detailed survey in remote area.[10]

Section D

11. What do you understand by inverted cone of depression and circle of influence in the well? Name the different method of tube well boring and indicate the conditions where each one is suitable. Sketch and explain geological condition which give rise to an artesian well. [10]
12. Critically examine how poor characterization and segregation of solid waste contribute to environmental and public-health crises. Using global best practices (e.g., Japan, Sweden), design a sustainable waste-management model suitable for developing countries and explain how it can be adapted to Nepal's socio-economic context.[10]

THE END

MODEL SET 24

लोक सेवा आयोग

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राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ।

Section A

1. What are the assumptions of design of axially loaded column ? Write designing steps for eccentrically loaded column .[5]
2. Discuss the general bearing capacity for piles in cohesive and cohesionless soils. Derive the skin-friction and end-bearing components, Explain negative skin friction, group effects and efficiency, and illustrate with a worked example.[10]
3. Write steps to follow for performing pile load test in field .[5]
4. What are the different types of foundation for bridge Describe briefly when each of these types is used.In the Terai region, a simple supported girder bridge faces strong wind loads during pre-monsoon storms.[5+5]

Section B

5. The mean monthly flow of typical Nepalese river is as follows: [10]

Month	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Q(m^3/s	8	7	6	7	10	38	90	100	60	30	16	10

Considering overall efficiency as o.88, head as 200 m and minimum environmental release a 10% of minimum monthly flow determine:

a) Total potential (power and energy) in each months considering no spilling is allowed.

b) If the power plant will run only for 6 months what will be design discharge and installed capacity of plant?

6. Compare lined vs unlined irrigation canal: types, design issues, losses (seepage, evaporation), lining materials and economics . Present a design problem for an irrigation canal: given bed slope, discharge, channel material, determine dimensions using Lacey's regime theory or other empirical method. Explain all steps and assumptions.[5+5]
7. What do you mean by hydraulic transient? How do you consider such phenomenon while designing a hydropower plant? [5]

Section C

8. Describe with sketches the elements of highway cross sections . Why are transition curve provided in the horizontal alignment of a highway explain with sketch ? What is a vegetation structure? Describe with sketches vegetative engineering techniques for slope stabilization [5+5]
9. What is slope protection ? Describe the types of retaining walls in hill road construction . Also ,mention importance of mass haul diagram road construction .[2+6+2]
10. Describe briefly the history of civil aviation in Nepal. List out the factors considered in the design of runways.[5]

Section D

11. **E**xplain why urban planning is necessary in Nepal. Describe the challenges being faced in distribution of water supply .[5]
12. Describe the various types of sewerage system. A sewerage system having a radius of 70 cm is laid with a gradient of 1 in 500. What will be the velocity of flow and discharge through the sewer when running one half full? Assume N=0.012 in Manning's formula.[2+3]
13. Evaluate the limitations of current IEE/EIA practices in South Asia, focusing on political influence, data reliability, and community participation. Suggest reforms for making environmental assessment more transparent and scientifically rigorous, and justify how these reforms would reduce long-term ecological risks.

THE END

MODEL SET 25

लोक सेवा आयोग

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राजपत्राङ्कित तृतीय श्रेणी (प्राविधिक) पदको प्रतियोगितात्मक लिखित परीक्षा

समय: ३ घण्टा **पूर्णाङ्क: १००**

पत्र: द्वितीय **विषय: Technical Subject**

तलका प्रश्नहरुको उत्तर Section अनुसार छुट्टाछुट्टै उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

Section A

1. Nepal is culturally and socially using timber as primary source of structure constructing material .What are its advantages and disadvantages in comparison to other materials in terms of safety ,strength ,durability and weather resisting property .[5]
2. What is the significance of the Standard Penetration Test (SPT) and Static Cone Penetration Test (SCPT) in site investigation? Describe the procedures, how to interpret results for bearing capacity and settlement estimation, and limitations of each.[10]
3. Write a detailed note on the factors influencing selection of foundation type, including site conditions, soil exploration results, structural loads, economy, construction methods, time constraints, environmental concerns, and how you would document your decision in a foundation report.
4. Compute the approximate horizontal wind pressure on a girder with 4 m exposed height and discuss how this influences girder design .[5]

Section B

5. What could be the best ideas to convert a farmer managed irrigation system to well-equipped efficient irrigation system with all essential structures. Elaborates with engineering solutions.[10]
6. Discuss the method of estimating low flows in a river using long-term flow records. Why are low-flow estimates important in water resources planning ?[5]
7. What are the sources of loss of energy stored in hydropower and how it is measured? The supply to a pressure turbine is under a head of 20m. As the turbine draws 0.5m/s of water the head lose in the 300 mm diameter supply line is 2.5m. Calculate the pressure intensity at the entrance to the turbine. Determine the energy absorbed by the turbine in kW. Ignoring the functional losses between the entrance and end of turbine, when a negative pressure 310 pa exists at the 500mm diameter reaction of the draft tube 1.5m below the supply line. Also find the output of the turbine, if its efficiency is 85%.[10]

Section C

8. Describe the water drainage system in urban area with neat sketch .The speed of overtaking and overtaken vehicle is 80 kmph and 65 kmph respectively in two way traffic . The acceleration of overtaking vehicle 3.6 kmph .Calculate Safe overtaking sight distance ,Minimum and desirable overtaking zone with neat sketch . [5+5]
9. What are the factors on which the thickness of a pavement depends ? Describe .[5]
10. Describe about traffic signals ? What are the advantages and disadvantages of traffic signals .There is “Pointing and Calling” adopted by Japan . Write its feasibility in context of Nepal with advantages and disadvantages . [5+5]

Section D

11. Describe the layout of water distribution system with neat sketches . [5]
12. Explain how the enhanced greenhouse effect contributes to such extreme climatic events, using examples from South Asia. Suggest two practical mitigation measures for vulnerable countries like Nepal.
13. Describe the difference between dilution and land treatment . Which one you prefer for urban areas ? Justify your answer .[5]

THE END