

Seat Number

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Structural Design & Drawing-II (1060)

P. Pages : 3

Time : Four Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any one** question from each unit.
5. Use of IS-800 & Steel table is permitted.
6. Assume suitable data if necessary.

UNIT - I

1. a) Determine the load transmitted per pitch of a double – cover butt joint connected by 22 mm diameter at 90mm pitch. The thickness of main plate is 16mm & that of cover plate is 10mm. Assume allowable tensile strength equal to 150mpa. Also calculate the efficiency of the joint. 7
- b) Determine the maximum load in the rivets of the eccentric connections as shown below. 18

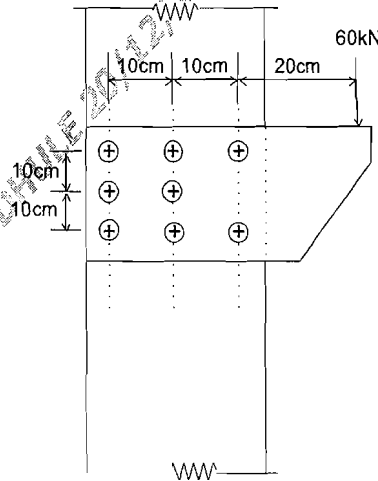


Fig : 1

2. a) Design an unequal angle section to acts as a tie member 1.56m long in a roof truss if it is carry an axial load of 120kN. 15
Use
i) Hand driver rivet at joints.
ii) Fillet weld at joints.
- b) Design a column to carry an axial load of 700 kN. The column has an effective length of 7m with respect to the x – axis & 5.0m with respect to the y – axis. 10

UNIT – II

3. Design the roof truss for following data in Fig 2.
i) Span of Truss = 10 m
ii) Spacing of Truss = 3.2m
iii) wt of sheets = 110 N/m².

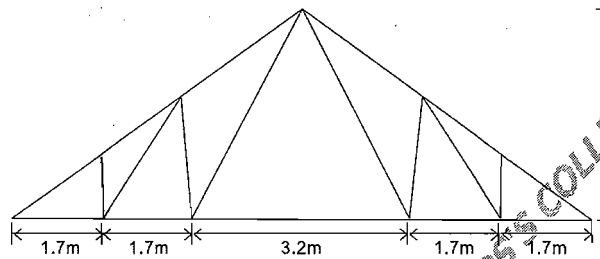


Fig : 2

4. Design a built up column 10 m long to carry an axial load of 750kN. The column is hinged of both ends. Provide single locking system with riveted connections for channels back to back use f_y of steel = 250 mpa. 25

UNIT – III

5. Design a plate girder 20m span to be provided in a hall. The super imposed load exclusive of self weight is 100 N/m² take f_y = 300 N/m². 25
6. Design a simply supported beam has an effective span of 6m carries use 25 kN/m f_y = 250 N/mm², E = 2.1×10^5 N/mm². the beam is laterally unsupported throughout. 25

UNIT - IV

7. Design a gusseted base for a column ISMB 350. The load on the column is 1200 kN. The safe bearing capacity of soil is 250 kN/m². & allowable bearing pressure on concrete is 4 N/m². 25
8. Design a foot over bridge for the following data in Fig :3 25
- Effective span = 18m
 - Height of truss = 1.8m (spacing of truss)
 - Panel width = 3m
 - R. C. C. slab = 110 mm.
 - Live load = 4000 N/m².

Design cross girder & member U₃ U₄. U₃ L₄ & L₃ L₄.

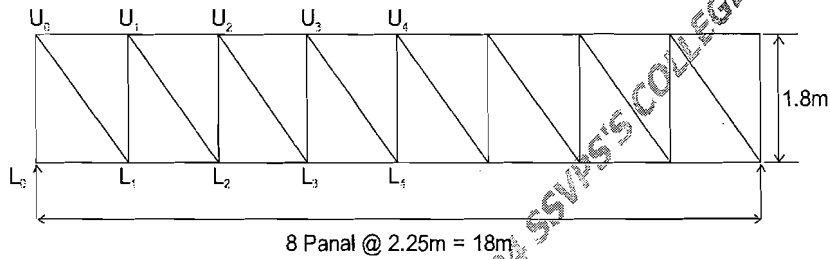


Fig : 3

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चंचल - 052

Theory of Structures - II (1070)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any one** question from each unit.
5. Neat diagrams must be drawn wherever necessary.
6. Use of non programmable calculator is allowed.
7. Assume suitable data if necessary.
8. Figures to right indicate full marks.

UNIT - I

1. a) Explain compatibility conditions. 5
b) Analyse the frame shown in fig. 1 by strain energy method. Draw SFD, BMD. 15

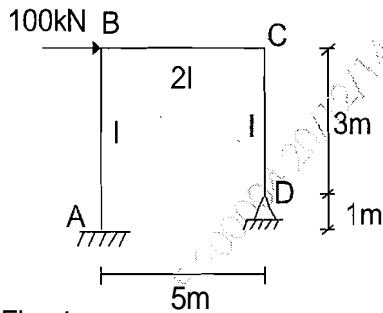


Fig. 1

चंचल - 052

P.T.O

2. Analyse the frame shown in fig. 2 by slope and deflection method and draw BMD. 20

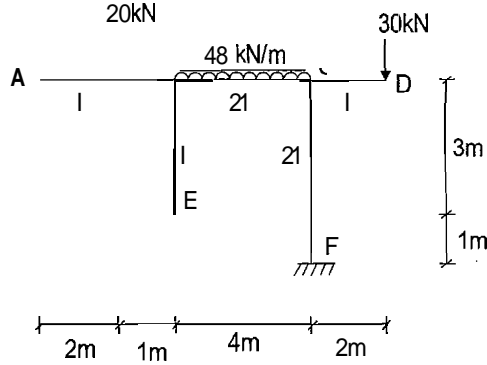


Fig. 2

UNIT - II

3. Using moment distribution method, analyse the frame shown in fig.3 and draw BMD. 20

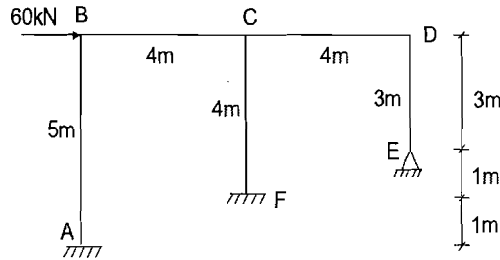


Fig. 3

4. Analyse the building frame as shown in fig. 4 by cantilever method, assuming that – all the columns have same area of cross section. 20

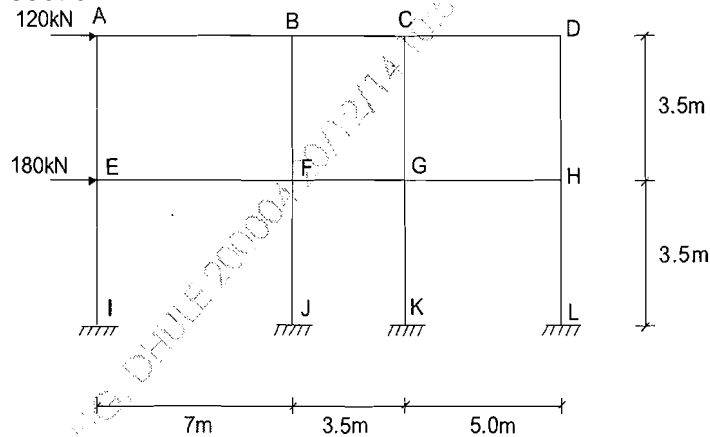


Fig. 4

UNIT - III

5. Support B of the continuous beam shown in fig. 5 has a downward settlement of **30 mm**. Calculate the support reaction at D by the flexibility matrix method. **20**

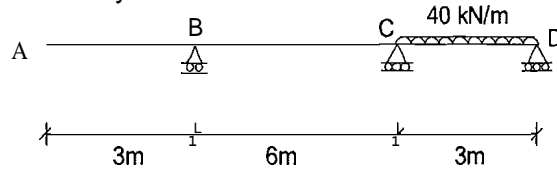


Fig. 5

6. Analyse the portal frame ABCD as shown in fig. 6 by flexibility method. EI constant throughout. **20**

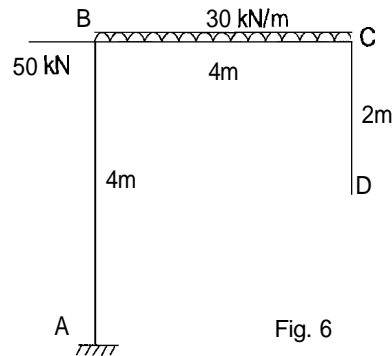


Fig. 6

UNIT - IV

7. Analyse the continuous beam shown in fig. 7 by displacement method. **20**

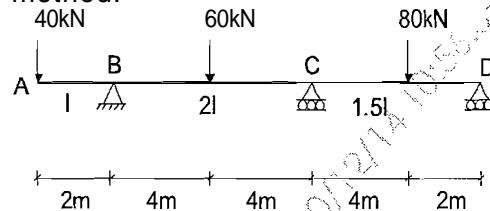


Fig. 7

8. Using stiffness matrix method, analyse the frame shown in fig. 8. Take EI constant throughout. **20**

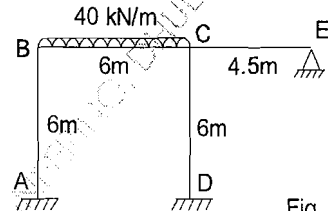


Fig. 8

UNIT - V

9. a) State and explain upper bound & lower bound theorems. 6
- b) Determine collapse load in the fixed beam as shown in fig. 9 in which plastic moment capacity is $2M_p$ in one half and M_p in the other half. 14

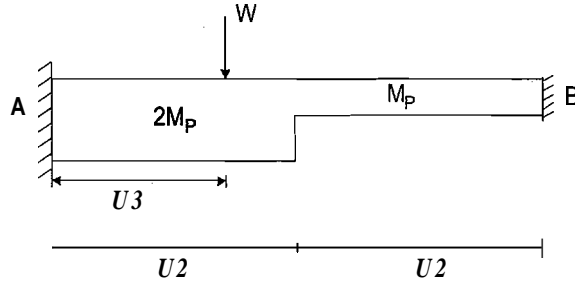


Fig. 9

10. a) Define with sketches various mechanism in plastic analysis. 6
- b) Determine the collapse load W_c for the frame shown in fig. 10. 14

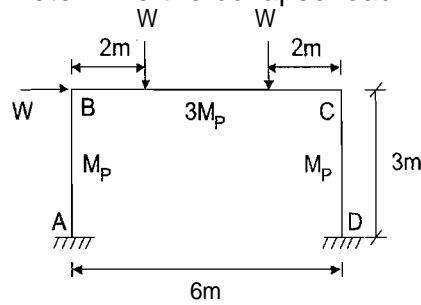


Fig. 10

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Transportation Engineering - II (1090)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub questions from each unit.
5. Non- programmable calculator is allowed.

UNIT - I

- a) Write down the factors to be considered for alignment of a new highway? 10
- b) Write a detailed note on water- bound, macadam road. 10
- c) i) Why was the Jayakar committee formed & what are its recommendations. 5
 ii) Explain obligatory points,. Discuss how these control the alignment. 5

UNIT - II

2. a) State & explain different traffic control devices. 10
- b) State the different test to be conducted on bitumen for testing quality & explain any one in detail. 10
- c) Explain types of road intersections with neat sketches. 10

UNIT - III

3. a) Explain important characteristics of aircraft which influences planning of airport. 10

- b) Calculate actual length of runway from the following data. 10
 Airport elevation = 100m.
 Airport reference temperature = 30°C
 Basic runway length = 650 m.
 Highest point along the length = 98.6 m.
 Lowest point along the length = 96.2 m.
- c) Write note on. 10
 i) Airport layout.
 ii) Runway, Taxiway.

UNIT - IV

4. a) Explain the different methods used in estimating the design discharge of stream. 10
- b) What are the factors to be considered while selecting a site for a bridge? 10
- c) The approximate cost of one superstructure span including flooring, girders, railing etc. & one pier of multiple spar bridge are tabulated below for various lengths of span. Determine the economic span. 10

Span (m)	10	15	20	25	30
Superstructure Cost (Rs)	4,000	11,000	16,600	23,500	39,700
Cost of one pier (Rs)	17,500	18,700	19,500	20,000	21,800

UNIT - V

5. Write short notes on any four. 20
- i) Bridge bearing.
 ii) Maintenance of bridge.
 iii) Movable steel bridge.
 iv) Cantilever bridge.
 v) Types of Bridge foundation.
 vi) Suspension Bridge.

Seat Number

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Environmental Engineering - I (1100)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Assume suitable data wherever required.
5. Solve **any two** questions from each unit.
6. Use of non - programmable calculator is permissible.

UNIT - I

1. Discuss the factors affecting per capita water demand. 10
2. Using following census data, predict the population of a city for 2021 using geometric increase Method: 10

Year	Population
1981	20000
1991	27000
2001	32000
2011	36500

3. Compare the characteristics of ground and surface water from drinking requirement point of view. 10

UNIT - II

4. a) Draw neat sketch of river water intake. 5
- b) Discuss the factors governing location of intake structure. 5

5. a) Discuss suitability of MS pipes for drinking water supply. 5
- b) What is water hammer effect? 5
6. Draw neat sketches of air valve, sluice valve, butterfly valve, pressure relief valve and drain valve. 10

UNIT - III

7. Describe procedure of determination of MPN value. 10
8. Give acceptable limits and cause of rejection limit of following parameters as per WHO specifications. pH, Hardness, turbidity, MPN, chloride. 10
9. Explain working principle of Jackson turbidity meter. What are its limitation? 10

UNIT - IV

10. What is the purpose of aeration? Draw neat sketch of any one type of aeration device. 10
11. Explain principle of working of alum with chemical reactions. Why alum is a preferred coagulant? 10
12. Design a rectangular plain Sedimentation tank for a population of 20000. 10

UNIT - V

13. Describe various mechanisms of Filtration. 10
14. Design a Rapid Sand Filtration System to Serve a population of 300000. 10
15. Draw break point chlorination curve and explain its significance. 10

Seat Number

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Geotechnical Engineering - II (1080)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.
5. Figures to the right indicates full marks.
6. Assume suitable data whenever necessary.
7. Non- programmable calculator is allowed.

UNIT - I

- | | | |
|----|--|---|
| 1. | a) Explain Rotary drilling. | 4 |
| | b) A sampling tube has an outer diameter 75 mm and wall thickness of 1.7 mm find the area ratio, Inside clearance, and outside clearance, also comment on whether the tube could be used for obtaining undisturbed soil sampler. | 4 |
| | c) Define Recovery Ratio. | 2 |
| 2. | a) Write down the Meyerhof's general equation for computing ultimate bearing capacity of soils below footings. Clarifying the basis and assumptions made in its analysis. | 7 |
| | b) Explain with, neat sketches the general shear failure below strip footing having (a) a smooth base (b) A rough base. | 3 |

3. Two model tests were made on footings to determine the bearing capacity of a site. The size of the footings and the load they took were as follows 10

Size of footing in m.	Load for 1.25cm Settlement in KN
0.3m x 0.3m	31.5 KN
0.6m x 0.6m	94.5 KN

Calculate the size of foundation required square in shape to transmit a load of 1350 KN with 1.25cm settlement. What will be the change in carrying load for the same footing. If allowable settlement is 25.0mm.

UNIT - II

4. a) Differentiate betⁿ initial settlement and consolidation settlement. 4
- b) A 30cm square plate settles by 18 mm in a plate load test conducted on a granular soil when the loading intensity was 200 KN/m². Estimate the likely settlement in a footing 1.5 m square resting on the same soil at the same intensity of loading.
5. a) Explain pressure bulb.
- b) Explain contact pressure for rigid and flexible bases with neat sketches.
6. Following data was obtained From a plate load test carried out on a 60 cm square test plate at a depth of 2 m below ground surface on a sandy soil which extends upto a large depth. Determine the settlement of a foundation 3.0m x 3.0m carrying a load of 110 t and located at a depth of 3.0 m below ground surface load test data. 10

P t/m ²	5	10	15	20	25	30	35	40
δ mm	2.0	4.0	7.5	11.0	16.3	23.5	34.0	45.0

water table is located at a large depth from the ground surface,

UNIT- III

7. Propose a strap footing for the following data allowable pressures. 10
 150 KN/m² for DL + reduced LL
 225 KN/m² for DL + LL

Colm loads	Colm A	Colm B
DL	500 KN	600 KN
LL	450 KN	800 KN

Proportion the footing for uniform pressure under DL+ reduced LL.
 Distance of C/c of column = 5.4m. Projection beyond Colm A not to exceed 0.5m

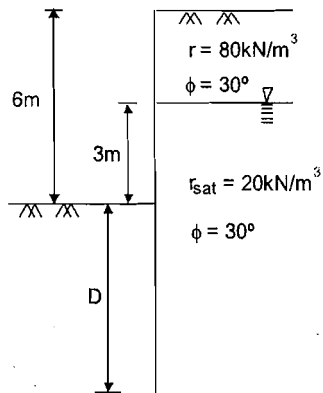
8. a) A footing 2.0m x 20m is located at a depth of 1.5m in a sand deposit. Borings have indicated that the avg. Corrected N value at the site is 25m water table is at a depth of 2m below the ground surface. Determine the net allowable bearing pressure for a factor of safety of 3 against shear failure and permissible settlement of 25 mm. Use tengs eqⁿ 8
- b) Deferential shallow foundation and deep foundation. 2
9. a) Explain i) Grillage foundation ii) minimum depth of foundation 10

UNIT - IV

10. Write down characteristics of B. C soil and required precautions for construction in black cotton soil in detailed. 10
11. Explain in detailed, bearing capacity of piles in group and write down any two empirical formulas for calculating group efficiency 10
12. Design a friction pile group to carry a load of 300 tonne including the weight of the pile cap at a site where the soil is uniform clay to a depth of 20 m underlain by rock. Avg. unconfined compressive strength of clay is 0.7 Kg/cm². The clay may be assumed to be normal sensitive & normally load with LL= 60% FS = 3 against shear failure. 10

UNIT - V

13. Compute the embedded length D of sheet pile wall as shown in fig. 10



14. Write down 10
- Pneumatic caisson
 - Sand island method.
15. a) Explain Pauw's analogy of foundation soil system for vertical vibrations. 4
- b) Using Barken's expression for natural frequency and the amplitude of vibrations, calculate the change in the percentage amplitude in terms of r if the soil mass participating in the vibration is 23% of m calculate this change for $r = 0.3$ and $r = 2.0$ 6

Seat Number

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Structural Design & Drawing - 1 (1010)

P. Pages : 3

Time: Four Hours

Max. Marks : 100

Instructions to Candidates :

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3. Students should note, no supplement will be provided.
4. Solve **any one** question from each unit.
5. Use of non-programmable calculator is allowed.
6. Ref. code IS 456:2000 is permitted.

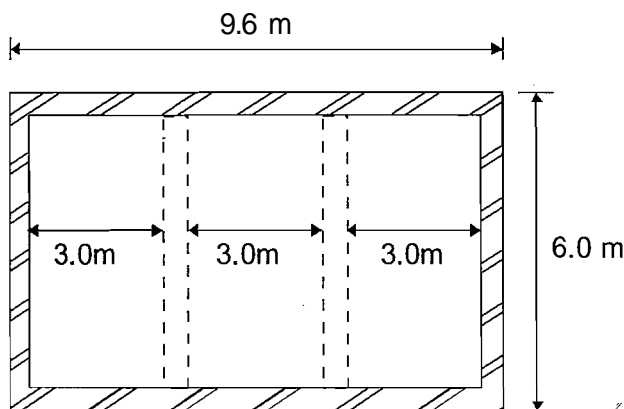
UNIT - I

1.
 - a) States various limit states of collapse and limit states of serviceability. 5
 - b) Show idealised stress- strain curve for concrete with all specific values. 5
 - c) Design a balanced singly reinforced concrete beam section for an applied moment of 60 kN-m. The width of the beam is limited to 175 mm. Use M-20 concrete and Fe-415 steel bars. 15
 If the effective depth of above balanced section is increased to 500 mm, find the reinforcement for the beam.
2.
 - a) Plot design stress block parameters for singly reinforced section with all values. 5
 - b) Write IS code provisions for finding moment of resistance of flanged section (T-beam) when $x_u < D_f$. 5
 - c) A reinforced concreted T-beam has the following data. 15
 Width of flange = 1600mm , Eff. depth = 350mm
 Thickness of flange = 105mm , Width of web = 250 mm
 Concrete grade = M- 20, Steel grade = Fe - 415.

Determine:- i) Limiting moment of resistance,
and ii) Limiting area of steel.

UNIT - II

3. a) Explain nominal shear reinforcement and give reasons for providing minimum Shear reinforcement. 5
- b) A cantilever beam projects 2.5m beyond the fixed end and carries a super-imposed load of 12 kN/m run. Design the cantilever beam using M-20 concrete grade & Fe-415 steel. The width of support is 350mm. 20
4. A rectangular hall measures 9.6m x 6.0m from inside and has walls 400mm thick. Total load on floor slab is 6 kN/m². Design a suitable R. C. T-beam. Use M-20 Concrete grade & Fe- 415 steel grade. Assume width of web as 300mm. 25



UNIT - III

5. a) Write basic criteria for design of one way slab. 5
- b) Design a R. C slab for a room having inside dimensions 3m x 7m. The thickness of supporting wall is 300mm. The slab carries 75mm thick lime concrete at its top, the unit weight of which may be taken as 20 kN/m³. 20
 The live load on the slab may be taken as 2kN/m². Assume the slab to be simply supported at ends. Use M-20 concrete grade & Fe-415 steel grade.
6. a) Distinguish between restrained slab and unrestrained slab. 5
- b) Design a dog-legged stair for a building in which the vertical distance between floors is 3.6m. The stair hall measures. 2.5m x 5.0m. The live load may be taken as 2.5 kN/m². Take Rise = 150mm, Tread = 250mm, Width of flight = 1.2m, Width of landing = 1.25m. Use M-20 concrete grade & Fe-415 steel. 20

UNIT – IV

7. a) Design a rectangular column of 4.5m Unsupported length, 12
restrained in position & direction at both the ends, to carry an
axial load of 1200 kN.
Use M-20 concrete grade & Fe-415 steel.
- b) Design a short circular column with helical reinforcement for 13
an axial load of 2000 KN. Use M- 20 concrete grade & Fe- 415
steel.
8. Design an isolated footing of uniform thickness of a R. C column 25
carrying a load of 800 KN and having a base of size 500mm x
500mm.
The safe bearing capacity of soil is 120 KN/m^2 . Check the
designed footing for one way shear and two way shear.
Use M-20 concrete grade & Fe- 415 steel.

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Seat Number

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Geotechnical Engineering - I (1030)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** question from each unit.
5. Use of non-programmable calculator is allowed.
6. Assume suitable data if necessary.

UNIT I

1. a) i) Explain any four field of soil Mechanics. 4
- ii) A fully saturated clay sample weight 130 gm and has a volume of 64 cm³. The clay weights 105 gm after oven drying. Assuming that the volume does not change during drying, determine the following. 6
 - a) specific gravity of Soil solids.
 - b) voids Ratio.
 - c) Porosity.
 - d) Dry Density.
- b) i) Define. 4
 - a) Consistency Index.
 - b) Liquidity Index.
 - c) Flow Index.
 - d) Toughness Index.

- ii) An undisturbed saturated specimen of clay has a volume of 189 cm^3 and mass of 30.20 gm . On oven drying the mass reduces to 18.0 gm . The volume of dry specimen as determined by displacement of mercury is 9.9 cm^3 . Determine the shrinkage limit, specific Gravity, shrinkage Ratio and Volumetric shrinkage. 6
- c) i) Explain Plasticity chart. 4
- ii) Derive functional Relation between void ratio, specific gravity, water content and Degree of saturation. 6

UNIT II

2. a) i) What are the assumptions in Boussinesq's theory. 4
- ii) In Proctor test, following observations were recorded. 6

Water Content %	5	10	14	20	25
Bulk Density kN/m^3	17.70	19.80	21.00	21.80	21.60

Plot the water content dry density curve and obtain the optimum water content and maximum dry density. Also assuming $G=2.65$. Draw the curve for 90% saturation line.

- b) i) What are the factors affecting compaction? Write in detail. 4
- ii) Determine the stress intensity 3 m below point load 0.5 m inside each of adjacent sides of a $1.8 \text{ m} \times 1.8 \text{ m}$ footing transmitting 1 Kg/cm^2 at the surface. Use Boussinesq's point load formula. 6
- c) i) Explain in detail with Figure contact pressure on cohesive and Cohesionless Soil. 4
- ii) Find the maximum vertical stress on a line saturated at $r = 2 \text{ m}$ from the axis of a concentrated load of value 20 kN and depth of maximum vertical stress from surface. 6

UNIT III

3. a) i) What are the factors affecting permeability? 4
- ii) A clay layer whose total settlement under a given loading is expected to be 16 cm settles 4 cm at the end of 1 month after the application of load increment. How many months will be required to reach settlement of 8 cm ? Assume the layer to have double drainage. 6

- b) i) Write short note on Taylor's Root time fitting curve. 4
- ii) In a falling head permeability test was performed on a sample of clean uniform sand. The initial hydraulic head was 900 mm. The final head was 400 mm and 60 sec were required for the water level in the stand pipe to fall. The cross sectional area of the stand pipe was 100 mm^2 . The sample was 40 mm diameter and had a length of 180 mm. Determine the coefficient of permeability in m/day. 6
- c) i) Write down formulae with usual notation and meaning for
- Compression Index.
 - Coefficient of compressibility.
 - Coefficient of volume change.
 - consolidation settlement.
- ii) Find the Ratio of average Permeability in the horizontal direction to that in the vertical direction for a soil deposit of 3 layers with thickness in the ratio 1:2:3 the permeability of second layer is twice that of the first and third is twice that of second. 6

UNIT IV

4. a) i) What are the advantages and disadvantages of Triaxial shear Test? 4
- ii) A vane 10 cm long and 8 cm in diameter was pressed soft clay at the bottom of the bore hole. Torque was applied on gradually increased to 45 Nm when failure took place. Subsequently the vane was rotated rapidly so as to completely remoulded the soil. The remoulded soil was sheared at a torque of 18 Nm. Calculate the cohesion of the clay in natural and remoulded states and also the value of sensitivity. 6
- b) i) What is Mohr's stress circle and Mohr's strength envelope? Explain with example. 4
- ii) Two specimen of sandy soil were tested in a triaxial test at cell pressure of 100 kN/m^2 and 250 kN/m^2 if Angle of internal Friction is 35° . What will be the axial stresses at failure. 6
- c) Two identicle'soil specimens were tested in a triaxial test. First specimens failed at deviator stress of 770 kN/m^2 . When the cell pressure was 200 kN/m^2 second specimen failed at a deviator stress of 1370 kN/m^2 . Under a cell pressure of 400 kN/m^2 . Determine the value of C and ϕ analytically. If the same soil is tested in a direct shear test apparatus with normal stress of 600 kN/m^2 . Calculate the shear stress at failure. 10

UNIT V

5. a) i) What are the causes of slope failure. 4
- ii) Compute the intensities of active and passive earth pressure at depth of 8 meters in dry cohesionless sand with an angle of internal friction of 30° and unit weight of 18 kN/m^3 . What will be the intensities of active and passive earth pressure if the water level rises to ground level? Take saturated unit weight of sand as 22 kN/m^3 6
- b) i) Explain with neat sketch. 4
- a) Earth pressure at rest.
- b) Active earth pressure.
- c) Passive earth pressure.
- ii) Calculate the factor of safety with respect to cohesion of a clay slope laid at 1 in 2 to a height of 10 m. If the angle of internal friction $\phi=10^\circ$, $C=25 \text{ kN/m}^2$ and $\eta = 19 \text{ kN/m}^3$. What will be the critical height of the slope in this soil. 6
- c) A vertical excavation was made in clay deposit having weight of 20 kN/m^3 . It caved in after the depth of digging reached 4 m. Taking the angle of internal friction to be zero. Calculate the value of cohesion. If the same Clay is used as a backfill against retaining wall, upto a height of 8 meters. Calculate 10
- i) Total Active pressure. ii) Total passive earth pressure.

Seat Number

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Transportation Engineering – I

(1040)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **all five** questions, from each unit attempt **any two** bits out of **a, b, c**.
5. Neat diagrams must be drawn wherever necessary.
6. Figures to the right indicate full marks.
7. Assume suitable data if necessary.

UNIT - I

- | | | |
|----|---|----|
| 1. | a) Compare Railway transportation with Road transportation and mention characteristics of Railway transportation. | 10 |
| | b) i) Discuss different types of rail joints with the help of neat sketches, give merits & mention limitation. | 5 |
| | ii) What are the describe qualities of good sleepers? | 5 |
| | c) i) What do you understand by permanent way? Mention the requirements of an ideal permanent way. | 5 |
| | ii) A. M. G. Track has a sleeper density of $n + 5$ if the track is laid with the rail of 13m length. Find out no. of sleepers under one rail length. | 5 |

UNIT - II

- | | | |
|----|---|----|
| 2. | a) Derive the relation between superelevation speed, gauge & radius of curve for a track on curved alignment; find expression for 'e' for B. G. | 10 |
| | b) i) What are the conditions in which use of curves is necessary in railway track. | 5 |

- ii) Explain the requirements of an Ideal track alignment. 5
- c) i) How do you define the superelevation? What are the objects of providing superelevation on a railway track? 5
- ii) Write Short Note on cant Deficiency. 5

UNIT - III

- 3. a) i) Describe the factors that influence the selection of site for railway station. 5
- ii) State necessity of points & crossing 5
- b) i) Explain acute angle crossing. 5
- ii) What are different types of signals? Explain any one in detail. 5
- c) i) Explain with neat sketch right hand turn out. 5
- ii) What do you understand by super high speeds? What are important limitations in attending the speed? 5

UNIT - IV

- 4. a) i) Discuss the importance of shaft in tunnel construction. 5
- ii) What are the advantages of pilot tunnel system? 5
- b) i) Describe heading & bench method of tunneling. 5
- ii) State the object in providing lining to the tunnel intension. 5
- c) i) What is mucking? Give the list of equipments used for this purpose & explain any one in detail. 5
- ii) Classify tunnel based upon shape & explain their adaptability. 5

UNIT - V

- 5. a) Write Short Notes 10
 - i) Classification of breakwaters
 - ii) Floating dry dock
- b) i) Explain about wharves 5
- ii) Write short note on Transit sheds. 5
- c) i) Differentiate between dry dock & wet dock. 5
- ii) Mention the factors which governs the choice of site for a harbour 5

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Numerical Methods Applications in Civil Engineering (1050)

P. Pages : 3

Time : Three Hours

Max. Marks 100

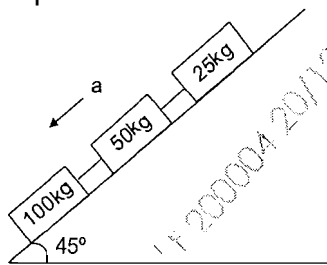
Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve any two questions from each unit.
5. Figures to right indicate full marks.
6. Use of non programmable calculator is allowed.
7. Assume suitable data if necessary.

UNIT – I

1. a) Develop algorithm of Newton Rapson method and draw flow chart. 10

- b) Three blocks are connected by a weightless cord and rest on an inclined plane. The following set of equations is formed. Solved for acceleration 'a' and tensions T and R in the two ropes. 10



$$100a + T = 519.72$$

$$50a - T + R = 216.55$$

$$25a - R = 108.27$$

- c) Following equation can be used to compute oxygen level in a river downstream where the sewage is discharged. 10

$$C = 10 - 20(e^{-0.2x} - e^{-0.75x})$$

Where x is distance in Km. Determine the distance where oxygen level first fall to 5. It is within 2Km.

UNIT – II

2. a) Explain working method of two- phase method. Write stepwise procedure in detail. 10
- b) The owner of a dairy is trying to determine the correct blend of two types of feed. Both contain various percentages of four essential ingredients. With the following data determine the least cost blend. 10

Ingredient	% per Kg. of feed		Min. Requirement (Kg)
	Feed 1	Feed 2	
1	40	20	4
2	10	30	2
3	20	40	3
4	30	10	6
Cost Rs/ Kg.	5	3	-

- c) Solve the L. P. P. by simplex Method. 10
- Max $Z = 4x_1 + 3x_2 + 6x_3$
- Subject to $2x_1 + 3x_2 + 2x_3 \leq 440$
- $4x_1 + 3x_3 \leq 470$
- $2x_1 + 5x_2 \leq 430$
- $x_1, x_2, x_3 \geq 0$

UNIT – III

3. a) It has been observed that rate of flow (Q) of water through the engine hose is a quadratic in pressure 'P' at the nozzle end. The observed data is; 10

Q	8.4	11	14.7	18	20
P	1.0	1.6	2.5	4.0	6.0

Obtain the relation between Q and P by using above data by method of least square.

- b) Find the values of $f(z)$, $f(8)$ and $f(15)$ from the following table by Newton's Divided difference Methods. 10

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

- c) From the following data, find θ at $x = 43$ and $x = 84$.

10

x	40	50	60	70	80	90
θ	184	204	226	250	276	304

UNIT - IV

4. a) The population of a certain town is given below. Find the rate of growth of population in 1931 and 1961.

10

Year (x)	1931	1941	1951	1961	1971
Population (y) (In thousand)	40.62	60.80	79.95	103.56	132.65

- b) Evaluate $\int \frac{dx}{1+x}$ with seven ordinates by using trapezoidal rule, Simpson's $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rule.

10

- c) Evaluate $\int_{-1}^{12} \left(10 + 20x - \frac{3x^2}{10} + \frac{4x^3}{100} + \frac{5x^4}{1000} + \frac{6x^5}{10000} \right) dx$

10

Using Gauss Legendre three point formula. Compare with exact results.

UNIT - V

5. a) $\frac{dy}{dx} = x^2 + y^2$, $y(1) = 1.5$, $h = 0.1$. Find $Y(1.1)$, $Y(1.2)$, $Y(1.3)$ Use R. K. 4^{th} order method.

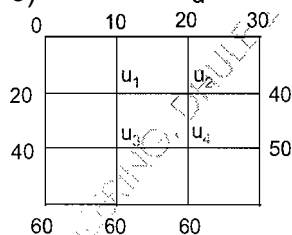
10

- b) Determine the value of $Y(0.4)$ using Milne's predictor corrector method, given $Y' = xy + y^2$, $y(0) = 1$. Use Taylor's series to get the values of $Y(0.1)$, $Y(0.2)$ and $Y(0.3)$.

10

- c) Solve $\nabla_u^2 = 0$ at nodal point for following square region.

10



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Fluid Mechanics - II (1020)

P. Pages : 3

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and solve **any two** out of a, b and c at one place only.
5. Figure to right indicates full marks.
6. Use of non - programmable calculator is allowed.
7. Assume suitable data if necessary.

UNIT - I

- 1 a) Sketch the boundary layer and velocity distribution along a long flat plate with stating factors influencing thickness of boundary layers. 10
Also calculate $\left(\frac{\delta^*}{\delta}\right)$ and $\left(\frac{\theta}{\delta}\right)$, assuming that the velocity distribution in boundary layer is given by $\left(\frac{v}{V_\infty}\right) = \left(\frac{y}{\delta}\right)^{1/7}$.
- b) Define drag and lift force. And calculate total drag, shear drag and pressure drag exerted on 1 m length of an infinite circular cylinder which has diameter 40 mm. air density 1.235 kg/m³ flowing past the cylinder with velocity of 3.75 m/minute. Take total drag coefficient 1.4 & shear drag coefficient 0.195. 10
- c) Explain hydrodynamically smooth and rough boundaries And calculate drag on semi tubular cylinder 90 mm radius with concave side upstream (drag coefficient = 2.1) sub merged in flowing water of velocity 0.6 m/sec. The length of cylinder is 7.6 m. 10

UNIT - II

2. a) Derive the Prandtl's universal velocity distribution equation 10

$$\frac{v_{\max} - v}{v^*} = 5.75 \log_{10} \left(\frac{R}{y} \right)$$

Also find the distance from the pipe wall at which the local velocity is equal to average velocity for turbulent flow in pipes.

- b) Define equivalent pipe. And solve 10

Two reservoirs are connected by a pipeline which rises above the level of highest reservoir. What will be the highest point of syphon above this level if length of pipeline upto this point is 540 m and diameter 0.35 m. The difference in level two reservoir is 12.6 m and total length of pipeline is 960 m. The syphon must run full. The separation of dissolved gases may occur at an absolute pressure 2.4 m of water. What will be the discharge under above condition. Assume $f = 0.4$ and allow for all losses.

- c) Explain hydraulic gradient line and total energy line. Define water hammer in pipes and derive the equation for rise in pressure head due to gradual closer of valve. 10

UNIT - III

3. a) Give the classification of channel bottom slope. And explain direct integration method of varied flow equation'. 10

- b) Draw neat sketch for hydraulic jump with showing specific energy curve and specific force curve. And solve A rectangular channel 9m wide carries $25 \text{ m}^3/\text{s}$ discharge is laid at slope 0.0001. If at a section in this channel depth is 1.6 m. How far (upstream or downstream) from the section will the depth be 2.0 m Take Manning's 'n' as 0.015. 10

- c) A trapezoidal channel, having bottom width 5 m and side slope 1:1 carries a discharge of $50 \text{ m}^3/\text{sec}$. Find the depth conjugate to initial depth 0.75 m before jump Also determine the loss of energy in jump. 10

UNIT - IV

4. a) Define impact of jet. And solve a metal plate 10 mm thick 200 mm square is hung so that it can swing freely about the upper horizontal edge. A horizontal jet of water of 20 mm diameter impinges with its axis perpendicular and 50 mm below the edge of hinge and keeps it steadily inclined at 30° to vertical. Find the velocity of jet if the specific weight of metal is 75.6 kN/m^3 . 10

- b) An inward flow reaction turbine with overall efficiency 80% is required to develop 152KW. The head is 8 m peripheral velocity of wheel is $0.96\sqrt{2gH}$. The radial velocity of flow $0.36\sqrt{2gH}$. The wheel has to make 150 rpm and hydraulic losses in turbine are 21% of available energy. Determine angle of guide blade at inlet, wheel vane angle at inlet, diameter of wheel and width of wheel at inlet. 10
- c) Explain Governing of turbines and its necessity. Also explain the factors on which selection of turbines depends upon. 10

UNIT - V

5. a) Explain different efficiencies ϕ in case of centrifugal pumps and solve. 10
A turbine develops 7500KW under the head of 25 m under 135 rpm. What is the specific speed ? What would be its normal speed and out put under the head of 19.5 m.
- b) A centrifugal pump delivers water to a height 165 m. The impeller has diameter 360 mm and width 180 mm at inlet The corresponding dimensions at outlet are 720 mm and 90 mm respectively. It's rotation speed is 1200 rpm. The blade are curved backward at 30° to tangent at exist and the discharge is $0.389 \text{ m}^3/\text{sec}$. Determine theoretical head developed, manometric efficiency, pressure rise across the impeller assuming loss equal to 12% of velocity head at exist, pressure rise and loss of head in volute casing, vane angle at inlet and power required to drive the pump assuming an overall efficiency of 70% what would be corresponding mechanical efficiency. 10
- c) Explain priming of pumps. And solve A centrifugal pump impeller has diameters at inlet and outlet as 360 mm and 720 mm. The flow velocity at outlet is 2.4 m/sec and vanes are set back at an angle 45° at the outlet. If the manometric efficiency is 70 percent, calculate the minimum starting speed of pump. 10

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Fluid Mechanics - II

(115103)

P. Pages : 3

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Carefully read the instruction on Answer sheet & follow the same.
5. Solve **any two** sub questions from each of five units.
6. Each sub-question carries **eight** marks.
7. Solve all parts of a unit in one stretch only.
8. Assume suitable data, if necessary.

UNIT - I

1. a) A metal plate $3\text{m} \times 1.5\text{m}$ is held horizontally (parallel to length) in the flow of water of 1.25 m/s velocity. If boundary layer at leading edge is laminar, find - distance from leading edge where nature of boundary layer changes, thickness of boundary layer at this section, frictional drag considering both sides. Neglect thickness of plate. Take $\mu = 0.01$ poise for water and critical $Re = 5 \times 10^5$. 8
- b) What do you understand by separation of boundary layer? Enumerate with sketches various methods of avoiding & controlling it. 8
- c) A cylinder 1 m diameter and 10 m long has axis perpendicular to the stream of air of velocity 10 m/s . Cylinder is rotating at 300 rpm . calculate - actual & theoretical lift per unit length, drag per unit length. Take $\rho = 1.24\text{ kg/m}^3$, $C_L = 3.4$, $C_D = 0.65$. 8

UNIT - II

2. a) State the mathematical conditions to identify whether the boundary is hydrodynamically smooth and rough. Also mention prandtl universal velocity distribution equation for turbulent flow in smooth and rough pipes. 8
- b) A rough pipe 400 mm diameter carries water, having velocity at a point 3 m/s which is 160 mm from axis of pipe. Velocity gradient is 20 per second at that point. Find k in mm, wall shear stress and average flow velocity. 8
- c) A 1400 m long pipe of 250 mm diameter connects two tanks with water surfaces differing by 22 m. Pipe has to pass an hillock whose top is 5 m above the water level in upper tank. Inlet leg from upper reservoir to summit is 300 m. Find minimum depth of pipe below the top of hillock if separation pressure is 7.8 m of water vacuum head. Assume $f = 0.025$ and atmospheric pressure 10.3 m of water head. Also find volume rate of flow. 8

UNIT - III

3. a) Define kinetic energy correction factor. And solve velocity distribution in open rectangular channel is given by $v = 3y^{1/2}$. If the width of channel is 10 m and the depth of flow is 1 m, find the average velocity of the cross - section, energy correction factor α & kinetic energy in terms of average velocity. 8
- b) A road side gutter has a triangular section with one side vertical and the other with a slope of Z horizontal to 1 vertical. Show that the discharge through the gutter is given by

$$Q = \frac{0.315}{n} \cdot f(Z) \cdot y^{8/3} \cdot S^{1/2}$$
 where, n = Manning's constant, s = Bed slope
 y = Depth of flow in the channel.

$$f(Z) = \frac{Z^{5/3}}{\left[1 + \sqrt{Z^2 + 1}\right]^{2/3}}$$
 8
- c) A rectangular channel has a width of 2 m and carries a discharge of $2 \text{ m}^3/\text{s}$ with a depth of 0.25 m. Calculate the specific energy, the depth alternate to existing depth, Froude number for alternate depths, critical depth & specific energy at that depth. 8

UNIT - IV

4. a) Derive the dynamic equation for gradually varied flow in the form. 8

$$\frac{dy}{dx} = \frac{S_0 - S_f}{1 - F_r^2}$$
- b) Depending upon the Froude number before jump give classification of hydraulic jump and state the practical uses of hydraulic jump. 8
- c) A spillway discharges a flood at the rate of $500 \text{ m}^3/\text{s}$ over a width of 70 m and the discharge then passes over an apron of the same. The tail water depth of 6 m causes an hydraulic jump on the horizontal apron. Determine – depth before jump height of the jump, length of the jump, energy lost in the jump. 8

UNIT - V

5. a) A jet of water strikes a stationary curved vane tangentially without shock at the inlet tip with a velocity of 30 m/s. The direction of the jet is deflected through an angle 60° from the original direction & there is 20% reduction in velocity when the jet passes over the vane. If the weight of water striking the vane is, 20N/S, calculate the magnitude & direction of the resultant force on the vane. 8
- b) Give classification of hydraulic turbine. Differentiate between impulse & reaction turbines. 8
- c) What do you mean by manometric, mechanical, volumetric, hydraulic and overall efficiency of a centrifugal pump. State their formulae? 8

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Infrastructural Engineering - I (115102)

P. Pages : 2

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub-question from each unit.
5. Assume suitable data wherever necessary
6. Use of drawing instruments & non programmable calculators is permitted.
7. Figures to the right indicate full marks.

UNIT I

1. a) What is permanent way, Give the component parts & Explain the requirements of an ideal permanent' way. 8
- b) What are the various types of stresses induced in the railway track and Explain in detail each of them. 8
- c) Explain functions and types of sleepers & write a short note on concrete sleeper. 8

UNIT II

2. a) What are the requirements of an Ideal track alignment. 8
- b) Write a short note on. 8
 - i) Grade compensation on curves.
 - ii) pusher or Helper Gradient.
- c) Explain the different methods of plate laying. 8

UNIT III

3. a) What are the objectives of signaling state the types of signals & Explain semaphore signal. 8
- b) What are the functions of railway stations. Discuss the various requirements of railway station. 8
- c) Write a short note on: - 8
 - i) Monorail.
 - ii) Metrorail.

UNIT IV

4. a) Write the Factors affecting site selection of airport. 8
- b) Explain the characteristics of aircraft. 8
- c) What are the advantages of helicopters & Explain the characteristics of helicopters. 8

UNIT V

5. a) What is break water & Explain in brief types of breakwater. 8
- b) What are the factors governing the choice of site selection for harbour & give the classification of harbours. 8
- c) Write a short note on: - 8
 - i) light house.
 - ii) floating dock.

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Construction Management - I (115105)

P. Pages : 2

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** questions from each unit.
5. Answers to all the questions should be written in the same answer book.
6. Assume additional suitable data if necessary.
7. Use of non-programmable calculator is allowed.

UNIT - I

1. a) Explain stages in construction. 8
- b) Explain with neat sketch line and staff organisation. 8
- c) What are the essential qualities required for leadership? 8

UNIT - II

2. a) Activities and time estimates for the activities are shown in following table. Determine the probability of completing the project in 35 days. 8

Activity	Three time estimates in days.		
	Optimistic	Most likely	Pessimistic
1-2	6	9	18
1-3	5	8	17
2-4	4	7	22
2-5	4	7	10
3-4	4	7	16
3-5	2	5	8
4-5	4	10	22

Given: Standard Normal Distribution Function.

Z	+0.8	+0.9	+1.0	+1.1	+1.2
Probability %	78.81	81.59	84.13	86.43	88.49

- b) i) Write in brief history of management techniques. 4
 ii) What is independent float? Explain how it is calculated? 4
 c) i) What are advantages of network techniques? 4
 ii) Define critical path. Explain its importance. 4

UNIT - III

3. a) Following table gives a network programme for a construction activity. Carryout resource levelling. 8

Activity	Duration in days	Man power required per day
1-2	6	4
1-3	6	8
1-4	12	6
2-3	12	6
3-4	6	10

- b) Explain about cost curve. Explain the procedure of crashing the network. 8
 c) Explain in detail updating of network. 8

UNIT - IV

4. a) What is marginal utility? Explain the law of marginal utility. 8
 b) Explain the factors affecting elasticity of demand. 8
 c) Explain about profit and loss account. 8

UNIT - V

5. a) Explain with neat sketch hoe: 8
 b) What are the types of bulldozers? Explain moving earth with bulldozers. 8
 c) Explain with neat sketch dragline. 8

Seat Number

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Structural Design - I (115101)

P. Pages : 3

Time : Four Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Figures to right indicate full marks.
5. Use of non-programmable calculator and IS 456 is allowed.
6. Assume suitable data wherever required.
7. Solve **any one** question from each unit.

UNIT - I

1. a) Explain characteristic strength of material and characteristic loads on structure. 6
- b) Define the partial safety factor for materials and for loads. Also determine the factored loads : 10
 - i) for strength and
 - ii) for serviceability limits states, for the one-way slab of a reading room is estimated to have a thickness of 125 mm along with thickness of finishing's as 75 mm. The slab is to carry a live load of 4 kN/m^2 . Assume unit wt. of finishing and concrete as 22 kN/m^3 & 25 kN/m^3 respectively.
2. a) Explain different modes of failures of a reinforced concrete member under flexure. 6
- b) A singly reinforced beam of grade M20 has to resist an ultimate moment of 36 kN.m . Design the section using 0.45% steel of grade Fe 250. Assume the breadth of the beam equal to 230 mm. 10

UNIT - II

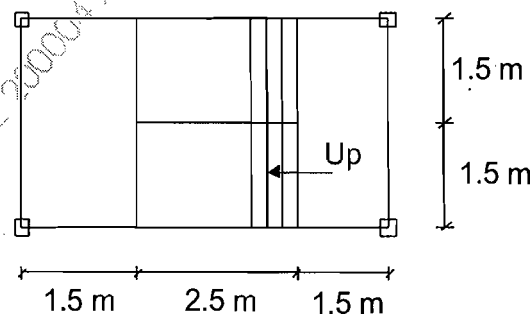
3. A beam 230 x 500 mm carry a factored moment of 190 kN.m. Find the area of steel required to this doubly reinforced beam s/c. Use M20 and Fe415. **16**
4. A Tee-beam consist of a flange 1100 mm wide and 120 mm deep. The depth of the beam is 600 mm upto the center of steel bar and width of web is 275 mm. Find the area of steel required for an ultimate moment of 520 kN.m. **16**

UNIT - III

5. A cantilever beam projects 2.5 m beyond the fixed end, and carries a super imposed load of 15 kN/m. Design the beam using M20 Fe415. Take width of support 350 mm. Provide shear reinforcements. **16**
6. Design a four span continuous R.C. slab for a hall 6.0 m wide and 13.0 m long. The slab is supported on RCC beams, each 230 mm wide which are monolithic. Design the slab for a live load of 2 kN/m². Assume the weight of roof finishing equal to 1.75 kN/m². Use M20 and Fe415. **16**

UNIT - IV

7. Design a R.C. slab for a room measuring 5 m x 7m size. The slab is monolithically constructed with beams supporting on all the four sides. The width of beam is 230 mm. The slab carries superimposed load of 3.5 kN/m² inclusive of floor finish. Use M20 and Fe415. **16**
8. Design a dog-legged stair for a building having floor to floor height of 3.30 m. The stair hall measures 3 x 5.5 m. Take live load along with floor finish as 3.5 kN/m². The columns are 230 mm x 230 mm. **16**



UNIT – V

9. A circular column 4.5 m high is effectively held in position at both the ends and restrained against rotation at one end. Design the column, to carry an axial load of 1050 kN, if its diameter is restricted to 400 mm. Use M20 and Fe415. 16
10. Design a rectangular isolated footing of uniform thickness for R.C. column bearing a vertical load of 650 kN and having size of 460 x 610 mm. The safe bearing capacity of soil may be taken as 125 kN/m². Use M20 & Fe415. 16

UNIT - 4

1. List out water - softening methods & explain any one method. 8
2. Explain fluoridation & de-fluoridation. 8
3. Write a note on 8
 - a) Reverse osmosis
 - b) Electro - dialysis

UNIT - 5

1. Give classification of water distribution system. Explain any one method. 8
2. List various types of valves. Explain function of each type with neat sketch. 8
3. Explain dead - end system of lay-out of distribution system. 8

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Environmental Engineering - I

(115104)

P. Pages : 2

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.
5. Assume suitable data if necessary.
6. Use of non-programmable calculator is allowed.

UNIT - 1

1. List population forecasting methods. Explain any two methods. 8
2. What is water intake structures? Give types of intake structure & explain any one type with neat sketch. 8
3. Explain types of water demand. 8

UNIT - 2

1. Explain physical characteristics of water. 8
2. Explain coagulation. What are common coagulants used in water treatment. Explain their comparative merits & de-merits. 8
3. Write a detail note on flash mixer. 8

UNIT - 3

1. Explain theory of filtration. List the materials used as filter materials. 8
2. Explain rapid sand filter with neat sketch. 8
3. What is disinfection? Explain various types of chlorination. 8

UNIT - 4

1. List out water - softening methods & explain any one method. 8
2. Explain fluoridation & de-fluoridation. 8
3. Write a note on 8
 - a) Reverse osmosis
 - b) Electro - dialysis

UNIT - 5

1. Give classification of water distribution system. Explain any one method. 8
2. List various types of valves. Explain function of each type with neat sketch. 8
3. Explain dead - end system of lay-out of distribution system. 8
