CBCS SCHEME

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17CV/CT51

Fifth Semester B.E. Degree Examination, July/August 2021
Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions.***
2. ***Use of IS456 – 2000, SP – 16 Permitted.***
3. ***Assume any missing data suitably.***

1 a. What is a Stress block? Derive from fundamentals the expression for area of stress block $0.36f_{uc}\, x_u$ and depth of centre of compressive force from the extreme fibre in compression $0.42x_u$. **(10 Marks)**

b. Briefly explain the modes of failure of beam sections with sketches. **(10 Marks)**

2 A rectangular simply supported beam of span 5m is 300mm × 650mm in cross section and is reinforced with 3 bars of 20mm on tension side as an effective cover of 50 mm. Determine short term deflections due to an imposed load of 20kN/m. Assume grade of concrete M_{20} and Fe 415 grade steel. **(20 Marks)**

3 A singly reinforced beam 300mm × 450mm in section is reinforced with 3 – bars of 20mm diameter with an effective cover of 50mm. Effective span of the beam is 6m. Assuming M_{20} concrete and Fe 415 steel, determine the Central Concentrated load P that can be carried by the beam in addition to its self weight. **(20 Marks)**

4 Calculate the area of reinforcement required for L – beam of flange width 1000mm , flange thickness 120mm , width of rib 250mm , total depth 750mm and effective cover 70mm to resist an ultimate bending moments (a) 400 kN-m (b) 75 kN – m. Assume concrete grade M_{20} and steel of grade Fe 415. **(20 Marks)**

5 A T – beam slab floor has 125mm thick slab forming part of T – beams which are of 8m clear span. The end bearings are 300mm thick. Spacing of T – beams is 3.5m. The live load on floor is $3kN/m^2$. Design one of the intermediate beams. Using M_{20} grade concrete and Fe 415 grade steel. Design the beam and sketch the details of reinforcement. **(20 Marks)**

6 Design a rectangular beam of section 230mm × 600mm of effective span 6m. Effective cover should be kept as 50mm imposed load on the beam is 40kN/m. Use M_{20} concrete and Fe 415 steel. **(20 Marks)**

7 Design a Cantilever slab projecting 1.5m from a beam. Adopt live load of $2.5\ kN/m^2$. Use M_{20} concrete and Fe 415 steel. Design the slab and sketch the details of reinforcement. **(20 Marks)**

8 Design a dog legged stairs for an office building in a room measuring 2.8m × 5.8m clear. Vertical distance between the floor is 3.6m. Width of the flight is to be 1.25m. Allow a live load of $3kN/m^2$. Use M_{20} concrete and Fe 415 grade steel. Assume the stairs are supports on 230mm walls at the end of outer edges of landing slabs. **(20 Marks)**

9 Design a square footing for a short axially loaded column of size 300mm × 300mm carrying 600kN load. Use M20 concrete and Fe 415 steel. SBC of soil is $180\ kN/m^2$. Sketch the details of reinforcement. **(20 Marks)**

10 An R.C. column of unsupported length 2.75m has to be designed for an ultimate axial load 3250 kN. Find cross – sectional dimensions of the column and reinforcement required. Use M_{20} grade of concrete and Fe 415 steel. Sketch the details of reinforcement. **(20 Marks)**

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17CV52

Fifth Semester B.E. Degree Examination, July/August 2021
Analysis of Indeterminate Structures

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

Module-1

1 a. Analyse the continuous beam shown in Fig. Q1 (a) by slope deflection method. Draw bending moment diagram. Take EI constant. **(10 Marks)**

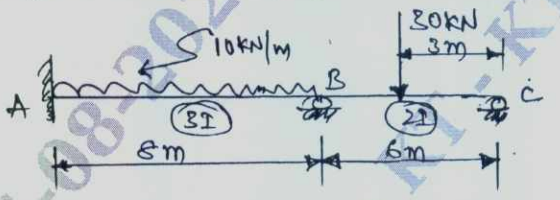

Fig. Q1 (a)

b. Analyse the portal frame shown in Fig. Q1 (b) by slope deflection method. Draw bending moment diagram. **(10 Marks)**

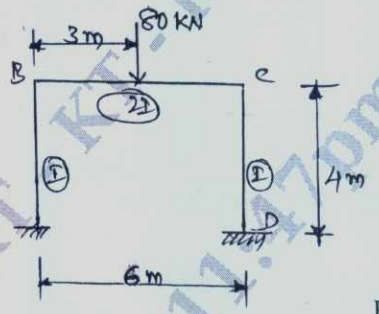

Fig. Q1 (b)

OR

2 a. Analyse the beam shown in Fig. Q2 (a) by slope deflection method. Draw bending moment and shear force diagram. Take EI constant. **(08 Marks)**

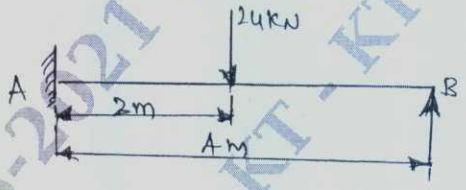

Fig. Q2 (a)

b. Analyse the frame shown in the Fig. Q2 (b) by slope deflection method. Draw bending moment diagram. **(12 Marks)**

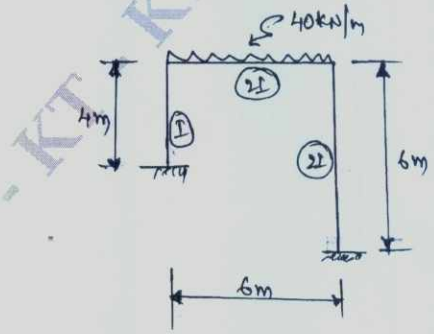

Fig. Q2 (b)

Module-2

3 Analyse the beam shown in Fig.Q3 by moment distribution method. Draw BMD, SFD and elastic curve. **(20 Marks)**

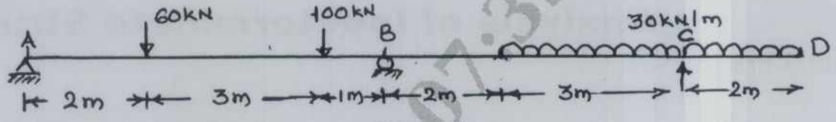

Fig. Q3

OR

4 Analyze the portal frame by moment distribution method. Draw bending moment diagram. Refer Fig. Q4. Take EI constant. **(20 Marks)**

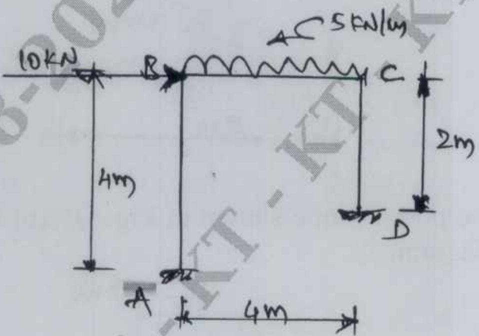

Fig. Q4

Module-3

5 Analyse the continuous beam by Kani's method. Refer Fig. Q5. Draw bending moment diagram. **(20 Marks)**

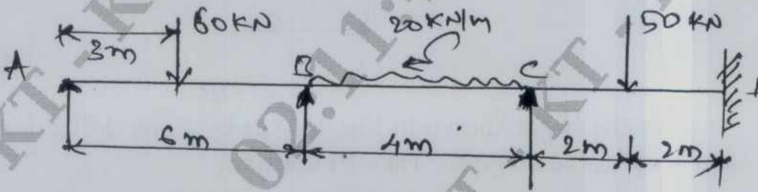

Fig. Q5

OR

6 Analyse the portal frame shown in Fig. Q6 by Kani's method. Draw bending moment diagram. **(20 Marks)**

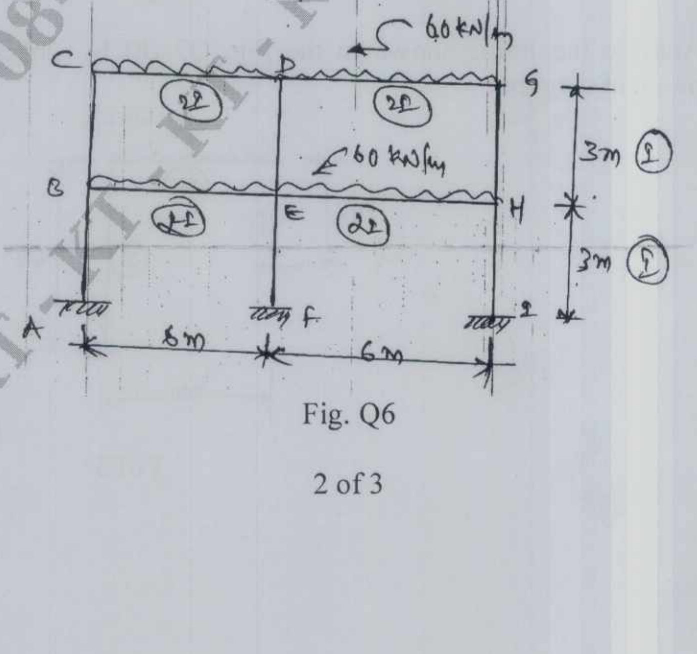

Fig. Q6

Module-4

7 Analyse the continuous beam shown in Fig. Q7 by flexibility method and draw bending moment diagram. Take EI constant. **(20 Marks)**

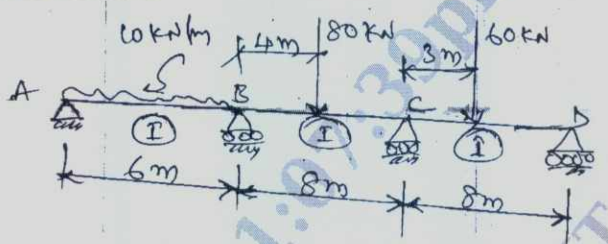

Fig. Q7

OR

8 Analyze the pin jointed truss shown in Fig. Q8 by flexibility matrix method and determine the forces in the members. Take force in the number OA is redundant. **(20 Marks)**

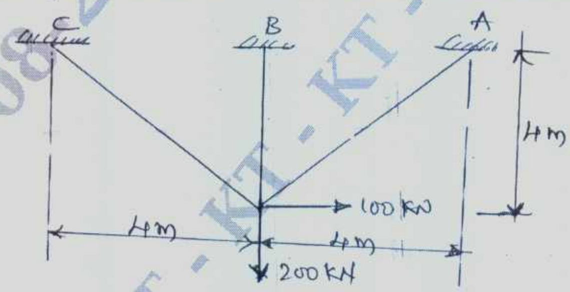

Fig. Q8

Module-5

9 Analyse the Portal frame shown in Fig. Q9 by stiffness method. Draw bending moment diagram. **(20 Marks)**

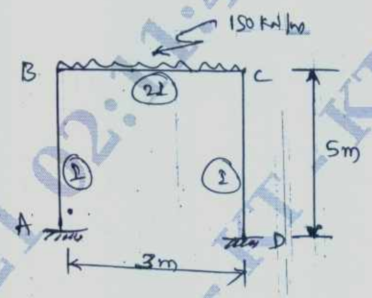

Fig. Q9

OR

10 Analyse the truss shown in Fig. Q10 by stiffness method and find the forces in the members. **(20 Marks)**

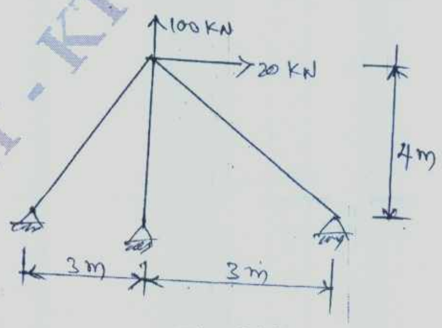

Fig. Q10

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17CV53

Fifth Semester B.E. Degree Examination, July/August 2021
Applied Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions.***
2. ***Use of IS : 6403 is permitted.***

1 a. What are the objectives of soil exploration? List the methods of exploration. **(08 Marks)**

b. Explain the terms with the help of a neat sketch of sampling tube :
i) Inside clearance.
ii) Outside clearance. Determine the area ratio for a sampler having outer diameter of cutting edge as 75mm and wall thickness as 1.7mm. Also state the type of sampler. **(07 Marks)**

c. Explain various types of soil samples. **(05 Marks)**

2 a. List the methods of dewatering during excavation and construction of foundations. Explain any one. **(06 Marks)**

b. Predict the ground water table given the following data :
Depth upto which water is boiled out = 18m , Water rise in I day = 0.95m , II day = 0.86m and III day = 0.78m. Use Hvorslev's method for predicting ground water table. **(06 Marks)**

c. Explain Seismic refraction method of exploration, with a neat sketch. **(08 Marks)**

3 a. Distinguish between Boussinesq's and Westergaard's theory of stress distribution. **(04 Marks)**

b. Find the intensity of vertical pressure at a point 4m directly below a 20kN point load acting on a horizontal surface. What will be the vertical pressure at a point 2m horizontally away from the axis of loading and also at the same depth of 4m? **(06 Marks)**

c. Construct an Isobar for a vertical stress of $20kN/m^2$ when ground surface is subjected to a concentrated load of 500kN. **(10 Marks)**

4 a. Explain equivalent point load method for determining vertical stress at any point within the loaded area. **(04 Marks)**

b. Explain components of settlement with its formula. **(08 Marks)**

c. A stratum of clay with an average liquid limit of 45% is 6m thick. Its surface is located at a depth of 8m below the ground surface. The natural water content of the clay is 40% and specific gravity is 2.7. Between ground surface and clay the subsoil consists of fine sand. The water table is located at a depth of 4m below the ground surface. The average submerged unit weight of sand is $10.5kN/m^3$ and the unit weight of sand above the water table is $17kN/m^3$. The weight of building that will be constructed on the sand above clay increases the overburden pressure on the clay by $40kN/m^2$. Estimate the settlement of building. **(08 Marks)**

5 a. Distinguish between Active earth pressure and Passive earth pressure with sketch. **(04 Marks)**

b. Explain Culmann's graphical method of finding Active earth pressure. **(06 Marks)**

c. A retaining wall 5m high retains a cohesion less backfill. The top 2.5m of the fill has a unit weight of $17kN/m^3$ and $\phi = 35^0$. Water table is at a depth of 2.5m from ground surface. The bottom 2.5m has a saturated unit weight of $18kN/m^3$ and $\phi = 38^0$. Draw active earth pressure distribution diagram. Determine total active earth pressure and its point of application. **(10 Marks)**

6 a. List the assumptions made in slope stability analysis. **(04 Marks)**

b. Calculate the factor of safety with respect to cohesion of a clay soil laid at a slope angle of 26.5^0 to a height of 10m, if $\phi = 10^0$, $C = 25kN/m^2$ and $\gamma = 19kN/m^3$. What will be the critical height of the slope in this soil? For $\beta = 26.5^0$ and $\phi = 10^0$, $S_n = 0.064$. **(04 Marks)**

c. A cutting 8.5m deep is to be made in a cohesive soil whose shear strength increases with depth. The slope of the cutting in 2H:1V. The properties of the soil are effective cohesion = $30kN/m^2$, Angle of internal friction = 20^0 and Unit weight = $19kN/m^3$. Determine the FOS for a trial slip circle passing through the toe of the slope by method of slices. The centre of slip circle can be located by Fellenius directional angles. For $\beta = 26.6^0$, $\alpha_A = 25^0$ and $\alpha_B = 35^0$. **(12 Marks)**

7 a. With the help of sketch, explain effect of eccentric loading on bearing capacity of soil. **(04 Marks)**

b. Explain different modes of shear failure, with neat sketches. **(06 Marks)**

c. A column carries a load of 1000kN. The soil is a dry sand weighing $19kN/m^3$ and having $\phi = 40^0$. A minimum factor of safety of 2.5 is required and Terzaghi's factors are required to be used $N_r = 42$, $N_q = 21$.

i) Find the size of square footing if placed at the ground surface.

ii) Find the size of square footing if placed at 1m below ground surface with water table at ground surface. Assume $\gamma_{sat} = 21kN/m^3$. **(10 Marks)**

8 a. Explain the procedure for determining the ultimate load capacity of soil by plate load test with a neat sketch. List its limitations. **(08 Marks)**

b. Calculate the net ultimate bearing capacity of a rectangular footing 1.8m × 3.6m in plan founded at a depth of 1.6m below the ground surface. The load on the footing acts at an angle of 16^0 to the vertical and it is eccentric in the direction of width by 15cm. The unit weight of soil is $18kN/m^3$. The shear parameters are $C' = 15kN/m^2$ and $\phi' = 30^0$. Natural water table is at a depth of 2m below the ground surface. Use BIS recommendations as contained in IS6403 – 1981. **(12 Marks)**

9 a. Explain in detail classification of piles based on material and function. **(10 Marks)**

b. A group of 9 piles, 10m long is used as a foundation for a bridge pier. The piles used are 30cm diameter with centre to centre spacing of 0.9m. The subsoil consists of clay with unconfined compressive strength of $15kN/m^2$. Determine the efficiency neglecting the bearing action. Take adhesion factor as 0.9. **(10 Marks)**

10 a. With the help of sketch, explain : i) Negative skin friction ii) Under reamed piles. **(10 Marks)**

b. A group of 9 piles arranged in a square pattern with diameter and length of each pile as 25cm and 10m respectively, is used as a foundation in soft clay deposit. Taking the unconfined compressive strength of clay as $120kN/m^2$ and the pile spacing as 100cm center to centre. Find the capacity of the group , Assuming bearing capacity factor $N_C = 9$, Adhesion factor = 0.75 and FOS = 2.5. **(10 Marks)**

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