CBCS SCHEME

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18CV53

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of IS : 456-2000, SP-16 is permitted.***
3. ***Assume suitable additional data, if necessary.***

Module-1

1 a. Distinguish between working stresses and limit state methods design. **(08 Marks)**

b. Write brief notes on :
i) Balanced section
ii) Under reinforced section
iii) Deflection
iv) Cracking. **(12 Marks)**

OR

2 a. Explain the factors that affect short and long term deflections. **(08 Marks)**

b. A cantilever of 3.5m span is 300mm wide and 600mm deep. It is subjected to a maximum bending moment of 125kN-m due to uniformly distributed service loads of which 50% moment is due to permanent loads. The beam is reinforced with 4 bars of 20mm diameter at an effective cover of 50mm in the tension zone. Determine the immediate deflection. **(12 Marks)**

Module-2

3 a. An RC beam of rectangular section 300mm wide and overall depth of 850mm is reinforced with 4 bars of 25mm diameter on the tension side. Effective cover is 50mm. Find the ultimate moment of resistance of the section, if $f_{ck} = 20N/mm^2$ and $f_y = 415N/mm^2$. Find the additional reinforcement required to make this a balanced section. **(10 Marks)**

b. Determine the moment of resistance of beam with the following data :
b = 350mm, d = 900mm, d′ = 50mm.
Tension reinforcement: 5-20mm of Fe415 grade; compression reinforcement 2-20mm of the same grade. Grade of concert M20. **(10 Marks)**

OR

4 a. A T-Beam of flange width 850mm, flange thickness 100mm, rib width 275mm has an effective depth of 475mm. The beam is reinforcement with 4-20mm bars. Find the ultimate moment of resistance. Use M20 concrete and Fe415 steel. **(10 Marks)**

b. Determine the shear capacity of the beam section with the following details:
Size 230mm × 720mm effective depth reinforced with 5 number of 16mm diameter with 8mm diameter stirrups @300mm C/C. Use Fe 415 steel and M20 concrete. **(10 Marks)**

Module-3

5 Design a beam of effective span 6m to support a total working load of 12kN/m including the self weight of the beam. The width of the beam is limited to 250mm. Design for flexure and shears only, No need to curtail the bars. Use 16mm diameter main bars and 8mm diameter stirrups. Use M20 concrete and Fe415 steel. Show reinforcement details. **(20 Marks)**

OR

6 A T-Beam and slab floor system has a slab 125mm thick spanning between T-Beams. Which are spaced at 3.5m apart. The beams have a clear span of 8m and end bearings are 300mm walls. The live load on the floor is $4kN/m^2$ and floor finish is $0.6kN/m^2$. Take overall depth of the beam equal to 600mm and web width to 300mm. Take self weight of the slab and web as 13.90kN/m provide 20mm diameter main bars and 8mm diameter two legged stirrups. Use M20 concrete and Fe415 steel. Design the intermediate T-Beam for flexure and shear only. **(20 Marks)**

Module-4

7 Design an RC slab for room measuring 4m × 5m is inside. The slab carries a live load of $2kN/m^2$ and is finished with 20mm topping of unit weight $24kN/m^3$. The slab is simply supported on all four edges with corners free to lift. No need to check for shear. Use M20 concrete and Fe415 steel. **(20 Marks)**

OR

8 Design a dog legged stair for an office building in a room measuring 2.8m × 5.8m, clear vertical distance between the floors is 3.6m. The width of flight is to be 1.25m. Assume imposed load of $3kN/m^2$. Use M20 concrete and Fe415 grade steel. Assume that the stairs are supported on 230mm width support at the outer edges of landing slabs. Sketch the reinforcement details. Design of one flight is enough. **(20 Marks)**

Module-5

9 a. A reinforced concrete column of 2.75m unsupported length carries an axial load of 1600kN. Design a square column using M20 concrete and Fe415 steel. Assume both ends of the column as hinged. **(10 Marks)**

b. Determine the reinforcement required for a short column for the following data :
Columns size : 300mm × 600mm, P_u = 1800kN ; M_{ux} = 110kN-m with respect to major axis. Use M25 concrete and Fe415 steel. Sketch reinforcement details. Assume 50mm effective cover. **(10 Marks)**

OR

10 A square footing has to transfer a load of 1000kN from a square column of 400mm × 400mm. Assume M20 concrete and Fe415 steel, and SBC of soil $200kN/m^2$. Design the footing and sketch reinforcement details. **(20 Marks)**

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