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17CV51

Fifth Semester B.E. Degree Examination, July/August 2022

Design of R.C. 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, SP16 allowed.

Module-1

- 1 a. Differentiate between Working Stress method and Limit State Method of RCC design. (06 Marks)
- b. Explain i) Characteristic load ii) Characteristic strength. (04 Marks)
- c. Derive the expression for the area of stress block $0.36 f_{ac} b x_u$ and depth of centre of compressive force from the extreme fibre in compression $0.42 x_u$. (10 Marks)

OR

- 2 a. Explain the factors affecting Short Term and Long term deflection. (06 Marks)
- b. A simply supported beam of rectangular section 200×450 mm overall is reinforced with 3-16mm diameter on tension side at effective depth 420mm spaced @ 50mm centres. The beam supports a load of 10kN/m, Effective span = 5m. Check the beam for limit state of serviceability of cracking by IS - 465 - 2000 method. (14 Marks)

Module-2

- 3 a. Differentiate between Under reinforced, Over reinforced and Balanced section. (06 Marks)
- b. Find the depth of Neutral axis of a singly reinforced RC beam of 250mm wide 550mm overall depth. It is reinforced with 4 - bars of 20mm diameter. Use M₂₀ concrete and Fe415 steel. Also check for type of section. Take clear cover as 40mm. (04 Marks)
- c. A Doubly reinforced beam section is 250mm wide, 500mm deep to the centre of the tensile reinforcement. It is reinforced with 3 bars of 16mm diameter as compression reinforcement at an effective cover of 50mm and 4 bars of 20mm diameter as tensile reinforcement. Using M₂₀ concrete and Fe500 steel. Calculate the moment of Resistance. (10 Marks)

OR

- 4 a. A Doubly reinforced rectangular beam of size 300mm \times 600mm, Simply supported at both the ends. The effective cover for both tension and compression steel is 35mm. The effective span is 6.0m. The beam carries a super imposed load of 24kN/m and super imposed dead load of 16kN/m. Use M-20 grade of concrete and HYSD steel Fe - 415. Determine tension and compression reinforcement. (10 Marks)
- b. A T - beam of depth of 450mm has a flange width of 1000mm and depth of 120mm. It is reinforced with 6-20mm ϕ bars on tension side with a cover of 30mm. If M-20 concrete and Fe - 415 steel are used. Calculate moment of Resistance of beam. Take $b_w = 300$ mm. (10 Marks)

Module-3

- 5 A simply supported RC beam supports a service live load of 5kN/m over a clear span of 4m. Support width is 300mm. Design the beam for flexure and shear. Check the beam depth for control of deflection using Empirical method. Take M₂₀ and Fe415 and also sketch the reinforcement details. (20 Marks)

OR

- 6 Design a Rectangular beam $230\text{mm} \times 600\text{mm}$ over an effective span of 5m. The superimposed load on the beam is 50kN/m . Effective cover to reinforcement is taken as 50mm. Use M_{20} concrete and Fe415 steel. Sketch the reinforcement details of the section. (20 Marks)

Module-4

- 7 a. Distinguish between one way slab and two way slab. (04 Marks)
b. Design a two – way RCC slab for a room $6\text{m} \times 4\text{m}$ supported on wall 230mm corners are held down. Live load 4kN/m^2 , floor finish 1kN/m^2 . Adopt M_{20} concrete and Fe415 steel. (16 Marks)

OR

- 8 Design a dog legged stairs for an office building in a room measuring $2.8\text{m} \times 5.8\text{m}$ 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 . Sketch the details of the reinforcement. Use M_{20} concrete and Fe415 steel. Assume the stairs are supported on 230mm walls at the end of outer edges of landing slabs. (20 Marks)

Module-5

- 9 a. Design a circular column to carry axial load of 1000kN. Use M_{25} and Fe415. Sketch the reinforcement details. (08 Marks)
b. Design a rectangular column subjected to an axial factored load of 1800 kN. Take effective length = 3.2m. Use M_{20} concrete and Fe415 steel. Check for minimum eccentricity. (12 Marks)

OR

- 10 A Rectangular column $450\text{mm} \times 600\text{mm}$ carries a DL of 800kN and a live load of 1400kN. The SBC of soil is 150kN/m^2 . Using M_{20} concrete and Fe415 steel. Design a rectangular footing. Sketch the details. (20 Marks)

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