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18CV53

Fifth Semester B.E. Degree Examination, July/August 2022 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. IS456-200 and SP(16) is allowed.**

Module-1

- 1 a. Explain the philosophy and principals of Limit state method of design. (08 Marks)
- b. Write brief note on :
 - i) Partial safety factors for load and material
 - ii) Characteristics load
 - iii) Characteristics strength (06 Marks)
- c. Explain balanced, under reinforced and over-reinforced sections. (06 Marks)

OR

- 2 a. Differentiate between working stress method and limit state method of RCC designs. (06 Marks)
- b. A rectangular section beam 200mm wide by 450mm overall depth is reinforced with 3 bars of 16mm diameter at an effective depth of 420mm. Two hanger bars of 12mm diameter are provided at the expression face. The effective span of the beam is 5m. The beam supports a service load of 10kN/m. If $f_{ck} = 20\text{N/mm}^2$ and $f_y = 415\text{N/mm}^2$. Compute : i) The short term deflection ii) The long term deflection. (14 Marks)

Module-2

- 3 a. A singly reinforced beam 250mm × 500mm is reinforced with 4 bars of 16mm diameter with an effective cover of 50mm. Effective span of the beam is 6m. Assuming M_{20} grade concrete and Fe415 steel determine central concentrated load 'P' that can be carried by the beam in addition to its self weight. (10 Marks)
- b. Determine the area of reinforcement required for a singly reinforced concrete section having breadth of 300mm and effective depth 600mm to resist a factored moment of 200kN-m. Take $f_{ck} = 20\text{N/mm}^2$ and $f_y = 415\text{ N/mm}^2$. (10 Marks)

OR

- 4 a. A RCC beam 300mm × 500mm is reinforced with 4 bars of 16mm diameter with an effective cover of 50mm. The beam is simply supported over a span of 5m. Find the maximum permissible udl on the beam. Use M_{20} grade concrete and Fe500 steel. (10 Marks)
- b. Calculate the moment of resistance of RCC rectangular section 250mm wide and 500mm deep. If is reinforced with 6 bars of 20mm diameter on tension side and 3 bars of 20mm diameter on compression side. The effective cover for both tension and compression reinforcement is 40mm. Use M_{20} grade concrete and Fe415 steel for the design. (10 Marks)

Module-3

- 5 Design a cantilever beam having 1.1m projection. The live load on the beam is 6kN/m use M_{25} concrete and Fe415 steel for the design. (20 Marks)



OR

- 6 A T-beam slab floor has a slab 150mm thick spanning between T-beams which are spaced at 3m center to center. The beam is having clear span of 10m. The end bearings are 450mm thick. The live load on the floor is 4kN/m^2 . Using M_{20} concrete and Fe415 steel design one of the intermediate beam (20 Marks)

Module-4

- 7 Design a slab for a room size $7\text{m} \times 3\text{m}$ which carries a live load of 2.5kN/m^2 . Use M_{20} concrete and Fe 415 steel for the design. (20 Marks)

OR

- 8 Design a dog legged stair case for a room $2.5 \times 4.5\text{m}$. The floor to floor height is 3.2m. Take live load 3kN/m^2 . Assume bearing 230mm. Use M_{20} concrete and Fe415 steel for the design. (20 Marks)

Module-5

- 9 a. Determine reinforcement to be provided in a square column subjected to biaxial bending with following details.

- Size of the column = $450\text{mm} \times 450\text{mm}$
- Concrete M_{25}
- Steel : Fe415
- Factored moment = 200kN-m
- Factored load = 2500kN

If the arrangement of steel i) on two sides ii) on four sides. (12 Marks)

- b. Determine the reinforcement to be provided in a short column subjected to biaxial bending with the following data :

- Size of the column = $400\text{mm} \times 600\text{mm}$
- Concrete mix = M_{25}
- Characteristics strength of steel = 415N/mm^2
- Factored load $P_u = 1600\text{kN}$
- Factored moment acting parallel to the longer direction $m_{ux} = 120\text{kN-m}$
- Factored moment acting parallel to the dimension $M_{uy} = 90\text{kN-m}$.

(08 Marks)

OR

- 10 Design a rectangular footing for a column $400 \times 600\text{mm}$ to carry a axial load of 1500kN . The safe bearing capacity of soil is 180kN/m^2 . Take M_{20} concrete and Fe415 steel for the design. (20 Marks)

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