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15CV51

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

Time: 3 hrs

Max. Marks: 80

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS – 456, SP16 chart permitted.
3. Assume missing data suitably.

Module-1

- 1 a. What is Limit state? Explain different limit states to be considered in the design of RC beams. (06 Marks)
- b. Explain the terms Singly Reinforced and Doubly Reinforced, with neat sketch. (04 Marks)
- c. What is Stress block? Derive from fundamentals for the area of stress block $0.36f_{ck} b x_u$ and depth of concrete of compressive force from the extreme fibre in compression $0.42 x_u$. (06 Marks)

OR

- 2 a. Briefly explain under reinforced, over reinforced and balanced with neat sketch. (08 Marks)
- b. A flanged beam of T – section is simply supported over an effective span of 8m. The beam has effective flange width of 1400mm, thickness of flange as 150mm, breadth of web as 300mm and effective depth of 450mm. It is reinforced with 4 bars of 25mm diameter in tension and 3 bars of 16mm diameter in compression. Check the beam for deflection. Use M20 and Fe 415 sheets. (08 Marks)

Module-2

- 3 a. A RCC beam of section 330mm × 500mm is reinforced with 3 – bars of 20mm diameter with an effective cover 50mm. The beam is simply supported over a span of 5m. Find maximum permissible UDL on the beam. Use M20 grade concrete and Fe 500 steel. (08 Marks)
- b. Design a rectangular beam for an effective span of 6m. The superimposed load is 80kN/m and size of the beam is limited to 300mm × 700mm overall with an effective cover 50mm. Use M20 mix and Fe 415 grade steel. (08 Marks)

OR

- 4 a. A RC T – beam having total depth 380mm and width 230mm is cast monolithically with slab 110mm thick. The beam is simply supported over a span of 4.44m and spaced 3m c/c. Concrete mix M20 and steel of grade Fe 500 have been used. Calculate the maximum UDL. The beam can carry and the corresponding steel. (10 Marks)
- b. A RC beam 230mm wide and 450mm deep is reinforced with 3nos of #16mm bars of grade Fe415, on the tension side, with an effective cover of 50mm. Ultimate design shear force is 80kN. Design the shear reinforcement. (06 Marks)

Module-3

- 5 A rectangular beam is to be simply supported on supports of 300mm width. The clear span of the beam is 6m. The beam is to have width of 230mm. The characteristic superimposed load is 12kN/m. Using M₂₀ and Fe500 steel, design the beam and sketch details of reinforcement. (16 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 6 Design a rectangular beam of section 300mm and 500mm over all. Effective span 6m and effective cover for reinforcement should be kept as 50mm. Superimposed load on the beam is 40kN/m. Use M_{20} concrete and Fe415 steel. Sketch details of reinforcement. (16 Marks)

Module-4

- 7 a. Distinguish between one way slab and two way slab. (04 Marks)
b. Design a continuous R.C. slab for a class room 7 m wide and 17.5m long. The roof is to be supported on RCC beams spaced at 3.5m intervals. The width should be kept 300mm. The super imposed load is 3kN/m^2 and finishing load is 1kN/m^2 . Use M_{20} concrete and Fe 500 steel. Show reinforcement details. (12 Marks)

OR

- 8 a. Design a R.C slab for a room measuring $6.5\text{m} \times 5.0\text{m}$. The slabs is to be cast monolithically over the beams with corners held down. The width of the supporting beam is 230mm. The slab carries superimposed load of 5kN/m^2 . Use M_{20} grade concrete and steel grade Fe500. Sketch details of reinforcement. (08 Marks)
b. Design a dog – legged stair for a building in which the vertical distance between floor is 3.6m. The stair hall measures $2.5\text{m} \times 5.0\text{m}$. the live load may be taken as 2.5kN/m^2 . Use M_{20} concrete and Fe 415 steel bars. (08 Marks)

Module-5

- 9 a. Explain the following : i) Pedestal ii) Short column iii) Long column. (03 Marks)
b. What are the assumptions made in the limit state of Collapse – compression? (04 Marks)
c. Design the reinforcement for a short axially load square column of size $450\text{mm} \times 450\text{mm}$ to support a load of 1500kN and Fe500 steel. (09 Marks)

OR

- 10 A rectangular column $400\text{mm} \times 600\text{mm}$ carries and live load of 2kN. The SBC of soil is 150kN/m^2 . Using M_{20} concrete and Fe415 steel. Design a rectangular footing to support the column. Sketch the details of reinforcement. (16 Marks)
