



Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Design of RCC Structural Elements

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting atleast TWO questions from each part.
 2. Use of IS:456-2000 and its design aid (SP-16) is permitted.
 3. Assume the missing data suitably.

PART – A

- 1 a. Explain in detail the necessity of considering partial safety factors in the limit state method of design. (05 Marks)
- b. Show that $X_{u,max} = 0.46d$ for Fe500 grade steel. (05 Marks)
- c. Explain balanced section, under reinforced section and over reinforced section in limit state method of RCC design. (05 Marks)
- d. Show that $P_{t,lim} = 41.4 \left(\frac{f_{ck}}{f_y} \right) \left(\frac{X_{u,max}}{d} \right)$, with usual notations. (05 Marks)
- 2 a. A singly reinforced beam 250mm × 500mm in section is reinforced with 4 bars of 16mm diameter with an effective cover of 50mm. Find the ultimate moment of resistance of the beam. Use M20 concrete and Fe415 grade steel. (08 Marks)
- b. A doubly reinforced beam 250mm wide and 450mm deep to the centre of tensile reinforcement. It is reinforcement with 2#16φ as compression reinforcement at an effective cover of 50mm and 4#25φ as tensile steel. Using M15 concrete and Fe250 steel, calculate the ultimate moment of resistance of the beam section. (12 Marks)
- 3 a. Explain short term deflection and long term deflection. (04 Marks)
- b. What is development length? Obtain the expression for development length in tension. (06 Marks)
- c. A rectangular simply supported beam of span 5m is 300mm × 650mm in cross section and is reinforced with 3 bars of 20mm diameter on tension side at an effective cover of 50mm. Determine the short term deflection due to an imposed working load of 20 kN/m (Excluding self weight). Assume M20 concrete and Fe415 grade steel. (10 Marks)
- 4 A T-beam slab floor has 125mm thick slab forming part of T-beams which are of 8m clear span. The end bearings are 450mm thick. Spacing of T-beams is 3.5m. The live load on the floor is 3 kN/m². Design one of the intermediate beams. Sketch the details of reinforcement. Use M20 concrete and Fe415 grade steel. (20 Marks)

PART – B

- 5 Design a R.C. slab for a room measuring 5m × 6m size. The slab is simply supported on all the four edges, with corners held down and carries a superimposed load of 3 kN/m² inclusive of floor finishes etc. Use M20 concrete and Fe415 steel. Adopt I.S. code method. (20 Marks)
- 6 a. Design a short axially loaded square column, 500mm × 500mm for a service load of 2000 kN. Use M20 concrete and Fe415 grade steel. (08 Marks)

- b. A column of size $300\text{mm} \times 400\text{mm}$ has effective length of 3.6m and is subjected to $P_u = 1100\text{ kN}$ and $M_u = 150\text{ kN-m}$ about the major axis. Design the column using M25 concrete and Fe415 grade steel, providing the steel.
- On two sides
 - On four sides
- Assume cover of 60mm . (12 Marks)

- 7 A rectangular column $400\text{mm} \times 600\text{mm}$ carries a live load of 2000 kN . The safe bearing capacity of the soil is 150 kN/m^2 . Using M20 concrete and Fe415 steel, design a rectangular footing to support the column. Sketch the details of reinforcement. (20 Marks)

- 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 floors is 3.6m . Width of flight is to be 1.25m . Allow a live load of 3 kN/m^2 . Use M20 concrete and Fe415 steel. Assume the stairs are supported on 230mm walls at the end of outer edges of landing slabs. Sketch the details of reinforcement. (20 Marks)
