USN

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

Time: 3 hrs.   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 $P_{t,lim} = 41.4\left(\dfrac{f_{ck}}{f_y}\right)\left(\dfrac{X_{u,max}}{d}\right)$, 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 $2\#16\phi$ as compression reinforcement at an effective cover of 50mm and $4\#25\phi$ 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 300mm × 400mm has effective length of 3.6m and is subjected to P_u = 1100 kN and M_u = 150 kN-m about the major axis. Design the column using M25 concrete and Fe415 grade steel, providing the steel.
   (i) On two sides
   (ii) On four sides
   Assume cover of 60mm. **(12 Marks)**

7 A rectangular column 400mm × 600mm carries a live load of 2000 kN. The safe bearing capacity of the soil is 150 kN/m². 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 reassuring 2.8m × 5.8m clear. Vertical distance between the floors is 3.6m. Width of flight is to be 1.25m. Allow a live load of 3 kN/m². 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)**

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