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Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Design of RCC Structural Elements

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.**
2. Use of IS456-2000 is permitted.
3. Use of SP-16 is permitted.

PART – A

- 1 a. Explain the necessity of reinforcement in concrete. (04 Marks)
 b. Why do we need cover to reinforcement? (04 Marks)
 c. What is meant by limit state? Discuss the different limit states to be considered in reinforced concrete design. (08 Marks)
 d. Why is the partial safety factor for concrete greater than that for reinforcing steel in the consideration of limit states? (04 Marks)
- 2 a. Obtain an expression for the limiting depth of neutral axis ($x_{u,lim}$) for a rectangular section with M20 grade concrete and Fe500 grade of steel with the help of strain diagram. (06 Marks)
 b. Generate expression to calculate the limiting moment of resistance for a reinforced concrete flanged section, when $x_{u,lim} > D_f$ and $D_f < 3/7 x_{u,lim}$.
 D_f – Thickness of the flange
 $x_{u,lim}$ – Limiting value of neutral axis depth. (08 Marks)
 c. Estimate the moment of resistance of a T-section with the following details :
 i) Effective flange width = 2300 mm
 ii) Thickness of flange = 150 mm
 iii) Web width = 300 mm
 iv) Effective depth = 700 mm
 v) Reinforcement : 8 – #25
 vi) Materials : M20 concrete and Fe415 steel. (06 Marks)
- 3 a. What are the major factors which influence crack-widths in flexural members? (04 Marks)
 b. Determine the short-term deflection as per IS code due to dead load and live load and long term deflection due to shrinkage of a cantilever beam of span 5 m subjected to dead load of 15 kN/m and live load of 15 kN/m at service state. The width and overall depth of beam are 400 mm and 750 mm respectively. It is reinforced with 6 – #25 at top and 2 – #25 at bottom with a clear cover of 25 mm. Materials used are M20 grade concrete and Fe415 steel. (16 Marks)
- 4 A T-beam and slab floor system has a slab 125 mm thick spanning between beams which are spaced at 3.5 m apart. The beams have a clear span of 7.5 m and end bearings are 230 mm wall. The live load on floor is 4 kN/m² and floor finish is 0.8 kN/m². Design the intermediate T-beam for flexure and shear. Sketch the details of reinforcement. Use M20 grade concrete and Fe-415 steel. (20 Marks)
 Note : The beam is simply supported on walls.

**PART – B**

- 5 Design a two-way slab for a hall of size $4.2\text{m} \times 5.2\text{m}$. The slab is supported all around on walls of width 230 mm. The slab has to carry a live load of 4 kN/m^2 and floor finish is 0.6 kN/m^2 . All the edges are discontinuous and corners are held down. Use M20 concrete and Fe415 steel. Also sketch the details of reinforcement. (20 Marks)
- 6 a. Why does the code require all columns to be able to resist a minimum eccentricity of loading? (04 Marks)
b. Enumerate the functions of the transverse reinforcement in a reinforced concrete column. (04 Marks)
c. Design a reinforced rectangular short column of size $300\text{mm} \times 400\text{mm}$ which has to carry an ultimate axial load of 733 kN and an ultimate moment of 100 kN-m with respect to major axis. Use M20 concrete and Fe415 steel. Also sketch the details of reinforcement. (12 Marks)
- 7 Design an isolated rectangular footing of uniform depth for a column of size $300\text{mm} \times 450\text{mm}$ which has to carry a load of 800 kN. Safe bearing capacity of soil is 200 kN/m^2 . Use M20 concrete and Fe415 steel. Also show the details of reinforcement through sketches. (20 Marks)
- 8 a. Explain the basic difference in structural behaviour between “Stair slabs spanning transversely” and “Stair slabs spanning longitudinally”. (04 Marks)
b. The clear dimensions of a stair case hall is $2.6\text{m} \times 5.2\text{m}$. The floor to floor height is 3.6m. Design one of the flights of dog-legged stairs considering live load as 3.0 kN/m^2 . Use M20 concrete and Fe415 steel. Assume that the landings span in the same direction as the stairs and are supported on 230 mm walls at the ends. Sketch the reinforcement details. (16 Marks)
