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Fifth Semester B.E. Degree Examination, June/July 2023 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. Use of IS456-2000 and SP(16) is permitted.
3. Assume Suitable additional data, if necessary.

Module-1

- 1 a. Distinguish between : i) Balanced section ii) Under reinforced section and iii) Over reinforced section with sketches. Which section is preferable and why? (10 Marks)
- b. What is stress block? Derive from the fundamentals the expression for the area of stress block $0.36 f_{ck} b x_u$ and depth of centre of compressive force from the extreme fibre in compression $0.42 \times x_u$. (10 Marks)

OR

- 2 a. Explain : i) Short term deflection ii) Long term deflection iii) Side face reinforcement. (09 Marks)
- b. A cantilever of 3.5m span is 300mm wide and 600mm deep. It is subjected to a maximum bending moment of 125kN-m due to uniformly distributed service loads of which 50% moment is due to permanent loads. The beam is reinforced with 4 bars of 20mm diameter at an effective cover of 50mm in the tension zone. Determine the immediate deflection. Grades of concrete and steel M₂₀ and Fe₄₁₅. (11 Marks)

Module-2

- 3 a. A singly reinforced beam (RCC) of 250mm × 450mm deep upto the center of reinforcement with 3 - #16 at an effective cover of 50mm, effective span of 6m. M₂₀ concrete and Fe₄₁₅ steel. Determine the central point load that can be carried/supported in addition to the self weight. (12 Marks)
- b. Determine the moment of resistance of a T-beam for the following data :
Effective depth = 400mm, Breadth of the flange = 740mm, Breadth of web = 240mm, Area of steel = 5 - # 20 and depth of flange = 110mm. Adopt M₂₀ grade concrete and Fe415 steel. (08 Marks)

OR

- 4 a. A doubly reinforced beam section is 300mm wide and 500mm deep to the centre of tensile reinforcement. It is reinforced with compression reinforcement of 300mm² at an effective cover of 50mm and tension reinforcement of 1800mm². Determine the safe moment of resistance of the section. M₂₀ grade concrete and Fe500 grade steel is used. (12 Marks)
- b. A Tee beam has the following data:
 - i) C/C spacing of beams = 3.2mt
 - ii) Simply supported effective Span = 8m
 - iii) Depth of slab = 150mm
 - iv) Size of web of beam = 300mm × 500mm
 Calculate the balanced moment of resistance. (08 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.

Module-3

- 5 a. Brief about codal provisions made in providing longitudinal and lateral reinforcement in beams. (05 Marks)
- b. A simply supported rectangular beam is supported on 300mm wide walls. Over a clear span of 6mtrs. Design the beam by using M₂₅ grade concrete and Fe 415 Grade steel, superimposed load on beam is 15kN/m and breadth of beam is 230mm. (15 Marks)

OR

- 6 a. What is Torsion? Write expression for equivalence bending moment and equivalent shear force for members subjected to torsion. (04 Marks)
- b. Design a intermediate T – beam for a hall measuring 6.5m × 12m (clear dimension). Beams are spaced at 3m C/C. Depth of slab is 150mm. superimposed live load on slab is 4.0kN/m² finishes is 1.0kN/m², Check for deflection also use M₂₀ grade concrete and HYSD bar of Fe 500 grade. Sketch the reinforcement details. (16 Marks)

Module-4

- 7 Design an RC slab for a room measuring 4m × 5m inside. The slab carries a live load of 2kN/m² and is finished with 20mm topping of unit weight 24kN/m³. The slab is simply supported on all four edges with corners free to lift, No need to check for shear, Use M₂₀ concrete and Fe 415 steel. (20 Marks)

OR

- 8 Design a dog legged stair for an office floor room measuring 2.8m × 5.8m, clear vertical distance between the floors is 3.6m. The width of height is to be 1.25 m. Assume imposed load of 3kN/m². Use M₂₀ concrete and Fe 415 grade steel. Assume that the stairs are supported on 230mm width support at the outer edges of landing slabs. Sketch the reinforcement detail. Design of one height is enough. (20 Marks)

Module-5

- 9 A corner column 400×400mm is subjected to a factored loads $P_u = 1300\text{kN}$, $M_{ux} = 190\text{kN/m}$ and $M_{uy} = 110\text{kN/m}$. Design the reinforcement in the column, assuming M₂₅ concrete and Fe415 steel and effective cover of 60mm. Assume it as a short column. (20 Marks)

OR

- 10 Design a square footing for a short axially loaded column of size 300mm×300mm carrying 600kN load. Use M20 concrete and Fe 415 steel. SBC of soil is 180kN/m². Sketch the details of reinforcement. (20 Marks)

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