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17CV/CT51

Fifth Semester B.E. Degree Examination, Aug./Sept.2020 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 missing data if any suitably.*

Module-1

- 1 a. Explain the philosophy and principles of limit state design method. (08 Marks)
 b. What is stress block? Derive from fundamentals the expression for area of stress block $0.36f_{ck}$ and depth of center of compressive force from the extreme fiber in compression $0.42x_u$. (12 Marks)

OR

- 2 a. Explain the following:
 i) Characteristic load
 ii) Characteristic strength
 iii) Partial safety factor. (06 Marks)
 b. A rectangular section $200 \times 450\text{mm}$ is reinforced with 3 number 16mm diameter bars at an effective depth 420mm. The beam has 2 hanger bars of 12mm diameter. With effective span 5m. The beam support a load of 10kN/m. Calculate short term deflection and long term deflection using M₂₀ grade concrete and Fe415 grade steel. (14 Marks)

Module-2

- 3 a. Define singly and doubly reinforced beams. List the situations when they are adopted. (06 Marks)
 b. A rectangular section of effective size $230\text{mm} \times 500\text{mm}$ is used as simply supported beam for an effective span of 6.3m. What is the maximum total udl allowed on the beam if maximum percentage of steel is provided on tension side. Use M₂₅ grade concrete and Fe415 steel. Take effective cover = 50mm. (14 Marks)

OR

- 4 a. A rectangular section of size $250\text{mm} \times 500\text{mm}$ is reinforced with 4 number 16mm diameter bars. With an effective cover 50mm and effective span 6m. Using M20 grade concrete and Fe415 steel calculate moment of resistance and central concentrated load that can be carried by beam in addition to its self weight. (12 Marks)
 b. An isolated T-beam, simply supported over a span of 6m has following dimensions: Width of flange 750mm, thickness of flange 125mm, overall depth 400mm, width of web 260mm, effective cover to tensile reinforcement 40mm. The beam is reinforced with 4 bars of 20mm diameter. Determine the moment of resistance if Fe415 bars are used. Take $\sigma_{cbc} = 5\text{N/mm}^2$ and $m = 19$. (08 Marks)

Module-3

- 5 A simply supported RC beam supports a service load of 8kN/m over an clear span 3m. Support width is 200mm. Using M20 grade concrete and Fe415 steel. Design the beam for flexure and shear. Sketch the reinforcement details. (20 Marks)

**OR**

- 6 A cantilever beam of span 4m carries a factored load 40kN/m. Take width of beam as 230mm. Design the beam for flexure and shear. Sketch the reinforcement details. Use M₂₀ grade concrete and Fe415 steel. (20 Marks)

Module-4

- 7 Design a cantilever Portico slab projecting 1.5m from the beam supporting a live load of 3kN/m². Adopt M₂₀ grade concrete and Fe415 steel. Sketch the reinforcement details. (20 Marks)

OR

- 8 Design a dog legged stair case of a private building hall measuring 2.2m × 4.7m. Width of landing is 1.1m. The distance between floor to floor is 3.3m. Take rise = 150mm and thread = 270mm, weight of floor finish = 1kN/m². Adopt M₂₀ grade concrete and Fe415 steel take live load = 3kN/m². Assume wall thickness of 230mm which supports the stairs at the end of outer edges of landing slabs. Sketch the reinforcement details. (20 Marks)

Module-5

- 9 Design an RCC column 400mm × 400mm to carry on ultimate load of 1000kN at an eccentricity of 160mm. Using M₂₅ grade concrete and Fe415 steel. Sketch the reinforcement details. (20 Marks)

OR

- 10 A square column of 400mm sides carries a load of 900kN. Design the footing for an SBC of soil 100kN/m². Show the check for one way shear, two way shear and bond strength. Adopt M₂₀ grade concrete and Fe415 grade steel. Sketch the reinforcement details. (20 Marks)
