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Question Paper Code : 50342

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fifth Semester

Civil Engineering

CE 8501 — DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

(Use of IS 456 permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Summarize the main concept of working stress method/Elastic theory of reinforced concrete structures.
2. How are the margin of safety assigned in elastic method and ultimate load method?
3. Enumerate the advantages of flanged beams.
4. Why is bond stress more in compression bars than in tension bars?
5. Interpret the necessity of secondary /distribution reinforcement in one way RC slab.
6. What is the minimum rise and tread that are to be provided in
 - (a) Residential building
 - (b) Public building
7. Discuss the function of lateral ties in a RC column.
8. Sketch the salient points on a typical axial — moment interaction curve of a column.
9. On what circumstances combined rectangular footings are suitable?
10. Define punching shear.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the codal recommendations for limit states of design.

Or

- (b) Derive the expression for the depth of neutral axis and moment of resistance of a rectangular singly reinforced balanced section under flexure and obtain design constants K, j and Q for M25 grade of concrete and Fe500 grade of steel. Adopt working stress method.

12. (a) A beam of rectangular section 300 mm width and 500 mm effective depth is subjected to factored moment of 175 kNm, factored shear force of 25 kN and factored twisting moment of 10 kNm. Determine the area of reinforcement to resist the above forces. Adopt M25 grade of concrete and Fe500 grade of steel.

Or

- (b) Calculate the ultimate moment of resistance of a singly reinforced T beam having flange width of 1200 mm, flange thickness of 120 mm and rib width of 300 mm. The effective depth of beam is 600 mm. The beam is reinforced with 8-25 dia bars. Adopt M25 grade of concrete and Fe500 grade of steel.

13. (a) A straight stair in a residential building is supported on wall at one side and by stringer beam on the other side, with a horizontal span of 1.2 m. The risers are 150 mm and tread 300 mm. Design the steps. Adopt M25 grade of concrete and Fe500 grade of steel. Take live load as 2.5 kN/m².

Or

- (b) Design the reinforcements required for a simply supported RC slab for a floor to carry a live load of 5.5 kN/m² (service load). The clear dimension of the room is 5 × 8 m with 230 mm walls all round. Assume a floor finish of 1.15 kN/m². Adopt M25 grade of concrete and Fe500 grade of steel.

14. (a) A braced reinforced concrete column of circular cross section of 500 mm diameter is to support a factored axial load of 2350 kN along with a factored moment of 180 kNm. The unsupported length of the column is 6.3 m with effective length of 5.5 m. design the column when it is to be provided with:

- (i) Lateral ties
(ii) Spiral reinforcement

Adopt M25 grade of concrete and Fe500 grade of steel.

Or

- (b) Design the reinforcements in a short column 400 × 400mm at the corner of a multi-storeyed building to support an axial factored load of 1500 kN, together with a biaxial moments of 55 kNm acting in perpendicular planes. Adopt M25 grade of concrete and Fe500 grade of steel.

15. (a) A rectangular column of size 300×450 mm transmits a limit state load of 600 kN at an eccentricity of 150 mm about the major axis. Design a suitable isolated footing for the column by the limit state concept. Safe capacity of soil is 200 kN/m^2 . Use M25 grade of concrete and Fe500 grade of steel. Sketch the reinforcement details.

Or

- (b) Design an isolated footing for a square column, 450×450 mm, reinforced with 8-25 dia bars, and carrying a service load of 2300 kN. Assume soil with a safe bearing capacity (gross) of 300 kN/m^2 at a depth of 1.5 m below ground. Adopt M25 grade of concrete and Fe500 grade of steel.

PART C — (1 × 15 = 15 marks)

16. (a) Design a reinforced concrete footing for a 345 mm thick masonry wall which supports a characteristic load of 225 kN/m including self-weight. Assume safe bearing capacity of soil is 140 kN/m^2 at a depth of 1.2 m below ground level. Adopt M25 grade of concrete and Fe500 grade of steel.

Or

- (b) Determine the reinforcements to be provided in a short RC column given the following data, by limit state method.
- (i) Size of column = 300×600 mm
 - (ii) Factored load = 1200 kN
 - (iii) Factored moments, $M_{ux} = 160 \text{ kNm}$ & $M_{uy} = 80 \text{ kNm}$
- Adopt M25 grade of concrete and Fe500 grade of steel.