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G 6518

M.E. DEGREE EXAMINATION, MAY/JUNE 2007.

Second Semester

Structural Engineering

ST 1651 — CONCRETE STRUCTURES

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Use of IS 456–2000 and SP 16 codes permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Can a doubly reinforced beam be under-reinforced? What is the normal practice?
2. What is the type of torsion exists in a beam semicircular in plan and fixed at the two ends? What is its effects on the design?
3. State atleast four functions of transverse reinforcement in columns.
4. Explain the mode of failure of a tied column.
5. When the load is applied at the bottom side of the deep beam, vertical steel reinforcement is necessary. Why?
6. What is the function of horizontal steel in a corbel?
7. Draw the yield line pattern of a rectangular slab fixed at the two adjacent supports and free at the other two supports.
8. Why the permissible punching shear strength of concrete as per IS code is higher than the flexural shear strength?
9. What is the effect of shear cracking on zone of plastification?
10. Why moment redistribution is limited when percentage of steel is higher?

PART B — (5 × 16 = 80 marks)

11. (a) A rectangular beam has a cross sectional dimensions 400 × 600 mm at support and it is reinforced with 7 bars of 25 mm dia at top, 2 bars of 25 mm at mid depth and 4 bars of 25 mm dia at bottom to carry certain bending moment and twisting moment. The shear steel at the support section is 2 legged 12 mm dia @ 150 mm c/c. Determine the ultimate torque carrying capacity of the section by the IS code method if the negative moment at the support, $M_u = 400$ kNm. Use M30 concrete and Fe 415 steel.

Or

- (b) Design a semicircular beam supported on three equally spaced columns. The centres of the columns are on a curve of diameter 15 m. The super imposed load on the beam per meter length is 10 kN. Use M 25 grade concrete and Fe 415 grade steel.
12. (a) A square column of size 500mm is reinforced with steel of area 7200 mm². The column carries a factored axial load of 3000 kN and a factored bending moment of 170 kNm in one direction. Determine the moment carried by the column in the other direction using IS code method. Assume that one - fourth of the total steel is located at each corner of the column. Use M30 concrete and Fe 415 steel.

Or

- (b) A braced R.C. column circular in section of 400 mm diameter having unsupported length of 8 m with one end hinged and other end fixed has to carry a factored axial load $P_u = 900$ kN. If concrete grade is M20 and steel grade is Fe 415, calculate the area of reinforcement required with an effective cover of 50 mm.
13. (a) An orthotropic reinforced grid 16 m by 20 m is required for the roof of an auditorium. The ribs are spaced at 2 m intervals. Live load on roof is 1.5 kN/m². Adopt M20 concrete and Fe 415 steel. Design suitable reinforcements in the grid beams and sketch the details of reinforcement.

Or

- (b) A single span deep beam has an overall depth of 4.0 m and an effective span of 6 m. The width of the beam is 400mm. The beam supports a uniformly distributed live load of 300 kN/m over the entire span. Using M20 concrete and Fe415 steel, design suitable reinforcements for the beam and sketch of the details.

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14. (a) Design an interior panel of a flat slab for a live load of 5 kN/m^2 . The panel size is $6 \text{ m} \times 6 \text{ m}$. The diameter of the column is 500 mm. Drops may be provided. Use M20 concrete and Fe415 steel. Sketch the details of reinforcement with cross section showing middle strip and end strip and plan at top and bottom.

Or

- (b) Design a rectangular slab of size $4 \text{ m} \times 6 \text{ m}$ continuous on all the four sides using yield line analysis. Assume a live load of 3 kN/m^2 and floor finish of 1 kN/m^2 . Use M20 concrete and Fe415 steel. Sketch the details.
15. (a) Determine the design moments at support and in the mid span region before and after redistribution of moments of 30 % for a fixed beam AB of span L carrying a uniformly distributed load. Draw the bending moment diagram in each case and show the points of contraflexure and points of maximum bending moment.

Or

- (b) Explain in detail the Bakers method of analysis and design of a three span continuous beam.
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