B 214

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Sixth Semester

Civil Engineering

CE 337 — STRUCTURAL DESIGN II

Time : Three hours Maximum : 100 marks

Use of IS : 456, IS : 875 and SP–16 are permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Discuss the merits and demerits of the traditional working stress method of design

2. What are the assumptions for the limit state of collapse in flexure?

3. Explain the need for corner reinforcement in two way–rectangular slabs, whose corners are prevented from lifting up.

4. Show that deflection control in normal flexural members can be achieved by limiting span/effective depth ratios.

5. Give percentages of tension steel (p_t) and compression steel (p_c) of a doubly reinforced section, how is it possible to decide whether the beam is under reinforced or over reinforced at the ultimate limit state.

6. Under what situations do the following modes of cracking occur in reinforced concrete beams (a) diagonal tension cracks ((b) flexural shear cracks.

7. Why is the design shear strength of concrete related to the percentage tension steel (p_t)?

8. Define 'development length'. What is its significance?

9. What is the main difference, in terms of structural behaviour, between a 'short column' and a 'slender column'?

10. What are the situations in which combined footing are preferred to isolated footings?

PART B — (5 × 16 = 80 marks)

11. A simply supported one–way slab has an effective span of 3.5 m. It is 150 mm thick, and is reinforced with 10 mm diameter bars @ 200 mm spacing located at an effective depth of 125 mm. Assuming M_{20} concrete and Fe 415 steel, determine the superimposed service load that the slab can safely carry (i) according to working stress method (ii) according to limit state method assuming a load factor of 1.5.

12. (a) A rectangular beam 300 mm wide is subjected to a bending moment of 30 kNm; shear force of 30 kN. Design the section. Use M_{20} concrete and Fe 415 steel. Adopt limit state method.

Or

(b) The flange of a T–beam is 1000 mm × 100 mm and the rib below is 250 mm × 300 mm. It is reinforced with 4 numbers of 25 mm diameter Fe 415 steel bars in tension side, at an effective cover of 50 mm. The grade of concrete adopted is M_{20}. Determine the moment of resistance of T–beam section.

13. (a) Design a two way slab 4 m × 5 m with adjacent edges continues and the rest two adjacent edges discontinuous. The slab is subjected to a live load of 5 kN/m^2. Use M_{20} concrete and Fe 415 steel. Adopt limit state method.

Or

(b) Design a simply supported slab to cover a hall with internal dimensions 4 m × 6m. The slab is supported on masonry walls 230 mm thick. Assume a live load of 3 kN/m^2 and a finish load of 1 kN/m^2. Use M_{20} concrete and Fe 415 steel. Assume that the slab corners are free to lift up. Adopt limit state method.

14. (a) Design a short square column, with effective length 3 m, capable of safely resisting the following factored load effects under uniaxial eccentricity.

(i) P_u = 1650 kN, M_u = 80 kNm,

(ii) P_u = 375 kN, M_u = 200 kNm. Assume M_{25} concrete and Fe 415 steel.

Or

(b) An RCC circular column of diameter 450 mm is to carry an axial load of 1500 kN. The effective height of column is 7.5 m. Design the column with helical ties. Adopt M_{25} concrete and Fe 415 steel.

15. (a) Design an isolated footing for a square column, 400 mm × 400 mm, reinforced with 8 numbers of 20 mm diameter bars, and carrying a service load of 2000 kN. Assume soil with allowable bearing capacity of 300 kN/m^2 at a depth of 1.5 m below ground. Adopt M_{20} concrete and Fe 415 steel.

Or

(b) Design a reinforced concrete footing for a 230 mm thick masonry which supports a total load of 220 kN/m length under service loads. Assume a safe soil bearing capacity of 150 kN/m^2 at a depth of 1 m below ground. Adopt M_{20} concrete and Fe 415 steel.

———————