

C 59283

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Name.....

Reg. No.....

**FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE**

**EXAMINATION, JUNE 2009**

CE 04 502—STRUCTURAL DESIGN—I

(2004 admissions)

Time : Three Hours

Maximum : 100 Marks

*Missing data if any, may be suitably assumed.*

*Use of IS456-2000 is permitted in the examination hall.*

- I. (a) Explain the terms characteristic strength and characteristic load.
- (b) Explain the terms balanced section, under reinforced section and over reinforced section.
- (c) What is meant by limit state ? Explain briefly the various limit states to be considered in the design.
- (d) Discuss the assumptions made in Limit State Design.
- (e) Why is it necessary to provide transverse reinforcements in a one-way slab ?
- (f) Differentiate between one-way slab and two-way slab.
- (g) Sketch the various geometrical configurations of stairs.
- (h) Classify the columns based on (i) the type of reinforcement and (ii) based on the type of loading.

(8 × 5 = 40 marks)

- II. (a) Determine the reinforcements required for a beam 300 mm wide and 600 mm deep overall, subjected to a moment of 120 kNm. Cover to reinforcement is 25 mm clear. The stresses in concrete and steel are not to exceed  $7 \text{ N/mm}^2$  and  $230 \text{ N/mm}^2$ .

Or

- (b) Determine the moment of Resistance of a singly reinforced beam 160 mm wide and 300 mm deep to the centre of reinforcement, if the stresses in concrete and steel are not to exceed  $5 \text{ N/mm}^2$  and  $140 \text{ N/mm}^2$ . The reinforcement consists of 4 bars of 16 mm diameter. Take modular ratio as 18.

Turn over

- III. (a) A rectangular beam of size 250 mm  $\times$  500 mm is subjected to factored bending moment of 100 kNm, factored torsional moment of 25 kNm and factored shear of 50 kN. Assuming M 25 concrete and Fe 415 steel, calculate the reinforcements required. Assume the effective cover as 40 mm. Adopt 22 mm diameter bars for longitudinal reinforcement and 10 mm diameter bars for stirrups.

Or

- (b) A simply supported beam of span 5 m is having 200 mm width and 400 mm deep. It is reinforced with 3 bars of 25 mm diameter at an effective cover of 50 mm. Materials used are M 20 concrete and Fe 415 steel. Determine the maximum allowable uniformly distributed load on the beam.
- IV. (a) Design the interior span of a 3-span continuous one-way slab for an office building. The slab is continuous over T beams spaced at 4m c/c. Use M 20 concrete and Fe 415 steel. Assume floor finish as 1 kN/sqm and live load 3 kN/sqm. Sketch the reinforcement details.

Or

- (b) Design a slab of effective span 6 m  $\times$  4 m, simply supported on all four sides. It has to carry a live load of 10 kN/sqm in addition to its self weight. Assume M 20 concrete and Fe 415 steel. Sketch the reinforcement details.
- V. (a) An axially loaded column has to carry a factored load of 1900 kN. One dimension of the column is restricted to 250 mm. The steel reinforcement should not exceed 2% of the cross section. Assuming M 25 concrete and Fe 415 steel, design the column.

Or

- (b) A straight stair in a residential building is supported on wall on one side and stringer beam on the other side. The risers are 150 mm, treads are 250 mm and the horizontal span of the stairs is 1.3 m. Design the steps. Use M 20 concrete and Fe 415 steel. Sketch the reinforcement details.

(4  $\times$  15 = 60 marks)