

6. A simply supported beam is 25 cm by 50 cm and has 2-20 mm TOR bars going into the support. If the shear force at the center of support is 110 kN at working loads, determine the anchorage length. Assume M20 and Fe415 grade TOR steel. **10**

#### Section D

7. A straight staircase is made of structurally independent read slabs, cantilevered from a reinforced concrete wall. Give that the riser is 150 mm, tread is 300 mm, and width of flight is 1.5 m, design a typical tread slab. Apply the live load specified in the IS Loading Code for stairs liable to be overcrowded. Use M 20 concrete and Fe 250 steel. Assume mild exposure conditions. **10**
8. Design a circular column to carry an axial load of 1500 kN using (i) lateral ties, (ii) helical reinforcement. Use M 25 mix and Fe 415 grade steel. Assume any missing data. Sketch the arrangement for longitudinal and lateral reinforcement. **10**

**July-22-00277**

B.Tech. EXAMINATION, 2022

Semester V (CBCS)

LIMIT STATE DESIGN OF CONCRETE  
STRUCTURES-I

CE-501

Time : 3 Hours

Maximum Marks : 60

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*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

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**Note :** Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D. Q. No. 9 is compulsory. Relevant codes are allowed. Assume any missing data.

#### Section A

1. Discuss the merits and demerits of the working stress method, ultimate load method and limit state method. **10**

2. Design a concrete mix for use in reinforced cement concrete work from the following data using BIS method :

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- (i) Characteristic strength at 28-days = 35 N/mm<sup>2</sup>
- (ii) Type of cement = 43 grade ordinary Portland cement
- (iii) Slump required = 75 mm, exposure = Moderate
- (iv) Maximum nominal size of aggregate = 20 mm
- (v) Specific gravity of coarse aggregate = 2.74
- (vi) Specific gravity of fine aggregate = 2.74
- (vii) The fine aggregate corresponding to grading zone II.

### Section B

3. Determine the moment of resistance singly reinforced rectangular section 250 × 350 mm (with clear cover of 40 mm). Take  $\sigma_{ck} = 20$  N/mm<sup>2</sup>,  $\sigma_y = 500$  N/mm<sup>2</sup>. Assume any missing data.

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4. Design the RC floor slab for a room of internal dimensions 4.0 m × 9.5 m. Assume the slab to be simply supported on 230 thick masonry walls. The slab is to support load of 4 kN/m<sup>2</sup> and surface finish of 1 kN/m<sup>2</sup>. Use M20 grade concrete, HYSD steel of Fe 415 grade. Draw reinforcement details.

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### Section C

5. (a) A plain concrete beam (M 20 grade concrete) has a rectangular section, 300 mm wide and 500 mm deep (overall). Estimate the 'cracking torque'. Also determine the limiting torque beyond which torsional reinforcement is required (as per the Code). Assuming  $\tau_c = 0.3$  MPa. 5
- (b) Determine the design torsional resistance of the beam under pure torsion. Assume moderate exposure condition. 5

- (i) How the effective span of continuous beam or slab is calculated ?
- (j) Briefly explain the concept of Diagonal tension failure and flexural shear failure. **10×2=20**

**(Compulsory Question)**

9. (a) What do you understand with the terms 'Anchoring reinforcing bars and anchorage bond' ?
- (b) Define characteristic and Mean Target Strength of concrete.
- (c) Difference between One-way slab and Two-way slab.
- (d) Differentiate between long and short column.
- (e) Discuss in brief 'Abrams law' and its application in reinforced concrete design.
- (f) Mention various types of staircases with sketches.
- (g) Mention the major difference between Singly reinforced beam and Doubly Reinforced beam.
- (h) Write the values of nominal cover to reinforcement in beams and columns for mild, moderate, severe and very severe conditions as per Indian standard code(s).