

# CBCS SCHEME

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15CV/CT51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024

## Design of RC Structural Elements

Time: 3 hrs.

Max. Marks : 80

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Use of IS456-2000 and SP-16 is permitted.  
3. Assume any missing data suitably.

### Module-1

- 1 a. Explain the following with sketch.  
i) Characteristics load  
ii) Characteristics strength  
iii) Partial safety factors. (06 Marks)
- b. Enumerate various limit states to be considered in design and explain briefly. (04 Marks)
- c. With neat sketch of stress – strain Diagram write the assumptions made in limit state designing. (06 Marks)

OR

- 2 a. What is Stress block? Derive expression for stress block parameters. (06 Marks)
- b. Explain briefly about balanced, under reinforced and over reinforced sections with strain Diagram. (04 Marks)
- c. Explain : i) Short term deflection  
ii) Long-term deflection  
iii) Slenderness limits for beam lateral stability. (06 Marks)

### Module-2

- 3 a. Differentiate between under reinforced, over reinforced and balanced section. (06 Marks)
- b. A RCC beam of section 300mm × 500mm is reinforced with 4 bars of 16mm diameter with an effective cover of 50mm. The beam is simply supported over a span of 5m. Find the maximum permissible udl on the beam. Use M20 grade concrete and Fe500 steel. (10 Marks)

OR

- 4 a. A RCC beam 250mm wide and 450mm deep is reinforced with 3 numbers of 20mm dia bars of grade Fe415, on the tension side with an effective cover of 50mm. If the shear reinforcement of 2 legged-8mm dia stirrups at a spacing of 160mm c/c is provided at a section, determine the design ultimate strength of the section. Assume M20 concrete. (07 Marks)
- b. A T-beam RC floor system consists of 120mm thick slab supported by beams at 3m c/c. The effective width and depth of web is 300\*580mm as shown in Fig.Q4(b). Main reinforcement consists of 8 bars of 20 mm dia. The grade of concrete and steel used are M20 and Fe415 respectively. Determine the moment of resistance of T-beam, if it is used as simply supported beam of span 3.6m.

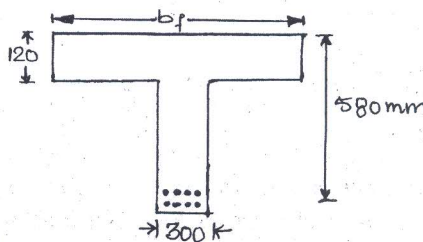


Fig.Q4(b)

(09 Marks)



**Module-3**

- 5 Design a reinforced concrete beam of rectangular cross-section using the following data: Effective span = 5m, width of beam = 250mm, overall depth = 500mm, service load including dead load and live load = 40kN/m, tension cover = 50mm. Adopt M20 grade concrete and Fe-415 grade steel. Sketch the reinforcement details. (16 Marks)

**OR**

- 6 a. List the circumstance under which doubly reinforced beam are recommended. (04 Marks)  
b. A rectangular beam 230mm × 550mm deep is subjected to a sagging BM of 40 kNm, shear force of 30kN and twisting moment of 11.5 kNm at a given section. Design the reinforcement if M20 grade concrete and Fe415 steel are used. Sketch the details. (12 Marks)

**Module-4**

- 7 a. What is Development length? Write expression for Development length of MS and HYSD bars. (04 Marks)  
b. Design a cantilever balcony slab having projection of 1.25mtr from beam face. Consider live load on slab 3kN/m<sup>2</sup> and floor finish 1kN/m<sup>2</sup>. Use M20 grade concrete and Fe 415 steel. Calculate the development length of main steel to be embedded. (12 Marks)

**OR**

- 8 a. Differentiate between one way and two way slab, and mention codal provisions for steel reinforcement in slabs. (03 Marks)  
b. Design two way slab for a room of size 4m × 5m. The slab is simply supported over 300mm thick wall. Live load and floor finish on slab is 4kN/m<sup>2</sup> and 1kN/m<sup>2</sup> respectively. Corners are held Down. Use M20 Grade concrete and Fe 415 Grade steel. (13 Marks)

**Module-5**

- 9 A corner column 400 \* 400 mm, is subjected to the factored loads  $P_u = 1300$  kN,  $M_{ux} = 190$  kN-m and  $M_{uy} = 110$  kN-m. Design the reinforcement in the column, assuming M25 concrete and Fe 415 steel and effective cover of 60 mm. Assume it as short column. (16 Marks)

**OR**

- 10 Design a square footing for a short axially loaded column of size 300 mm \* 300 mm carrying 600 kN load. Use M20 concrete and Fe415 steel. SBC of soil is 180 kN/m<sup>2</sup>. Sketch the details of reinforcement. (16 Marks)

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