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**Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024**  
**Design of RCC Structural Elements**

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.**  
**2. Use of IS – 456 – 2000 code, SP – 16 code book allowed.**

### Module-1

- 1 a. Differentiate working stress method and limit state method. (04 Marks)  
b. Explain stress block parameters with neat sketches. (08 Marks)  
c. Differentiate balanced, under reinforced and over reinforced sections. (08 Marks)

OR

- 2 a. What are the causes of cracks in reinforced concrete members? Explain. (06 Marks)  
b. A simply supported beam of rectangular section  $250 \times 450\text{mm}$  is used over an effective span of 4m. The beam is reinforced with 3 bars of 20mm diameter Fe-415 HYSD bars at an effective depth of 400mm. Two hanger bars of 10mm diameter are provided. The self wt of the beam together with the dead load on the beam is 4kN/m. Service load = 10kN/m, using M-20 grade concrete compute :  
i) The short term deflection  
ii) The long term deflection according to the Indian standard code IS : 456 – 2000. (14 Marks)

### Module-2

- 3 a. Calculate the ultimate flexural strength of a tee beam section having the following section properties.  
Width of flange = 1200mm,  
Depth of flange = 120mm  
Width of rib = 300mm  
Effective depth = 600mm  
Area of steel = 8 bars of 25mm diameter  
Materials : M<sub>20</sub> grade concrete, F<sub>e</sub> – 415 HYSD bars (06 Marks)  
b. A doubly reinforced concrete beam having a rectangular section 250mm wide and 540mm overall depth is reinforced with 2 bars of 12mm diameter in compression side and 4 bars of 20mm diameter in tension side. The effective cover to bars is 40mm. Using M-20 grade concrete and Fe – 415 HYSD bars. Estimate the flexural strength of the tension using IS – 456 – 2000 code recommendations. (08 Marks)  
c. A reinforced concrete beam of rectangular section with a width of 300mm and effective depth 600mm is reinforced with 4 bars of 25mm diameter as tension reinforcement. Two of the tensions bars are bent up at 45° near support section. The beam is also provided with double legged vertical links of 8mm diameter at 150mm centers near supports. Using M-25 grade concrete and Fe – 415 HYSD bars. Compute the ultimate shear strength of the support section. (06 Marks)

OR

- 4 a. What do you mean by doubly reinforced beam? Explain the necessity of providing doubly reinforced beam. (06 Marks)

- b. A tee beam has the following cross sectional details :  
 Effective width of flange = 2000mm, Thickness of flange = 150mm, width of rib = 300mm,  
 Effective depth = 1000mm, calculate the limiting or balanced moment capacity of the  
 section and area of tension reinforcement M20 and Fe415. (10 Marks)
- c. Explain shear failure of RC members. (04 Marks)

**Module-3**

- 5 Design a reinforced concrete beam of the rectangular section using the following data,  
 effective span = 5m, width of beam = 250mm, overall depth = 500mm, service load  
 (DL + LL) = 40kN/m, Effective cover = 50mm  
 Materials: M-20 Grade concrete, Fe -415 HYSD bars. (20 Marks)

**OR**

- 6 Design a L beam for an office floor to suit the following data,  
 Clear span = 8m, Thickness of flange = 150mm, Live load = 4kN/m<sup>2</sup>, Spacing bars = 3m,  
 $f_{ck} = 20\text{N/mm}^2$ ,  $f_y = 415\text{N/mm}^2$  L beams are monolithic with RC columns, width of column  
 = 300mm. (20 Marks)

**Module-4**

- 7 Design a two way slab for an office floor of size 3.5m × 4.5m with discontinuous and simply  
 supported edges on all the sides with corners prevented from lifting and supporting a service  
 live load of 4kN/m<sup>2</sup>. Adopt M-20 grade concrete and Fe415 HYSD bars. (20 Marks)

**OR**

- 8 Design one of the flights of a dog-legged stairs spanning between landing beams using the  
 following data, Number of steps = 10, Tread = 300mm, Rise = 150mm width of landing  
 beams = 300mm, Use M<sub>20</sub> grade concrete, and Fe – 415 HYSD bars ( $f_y = 415\text{N/mm}^2$ ).  
 (20 Marks)

**Module-5**

- 9 a. Design the reinforcement in a circular column of diameter 300mm to support a service axial  
 load of 800kN. The column has an unsupported length of 3m and braced against side way.  
 Column is reinforce with helical ties adopt M<sub>20</sub> Grade concrete Fe-415 HYSD bars.  
 (10 Marks)
- b. Design the reinforcements in a short column 400 × 400 mm at the corner of a multistoried  
 building to support an axial factored load of 1500kN, together with biaxial moments of  
 50kN-m acting in perpendicular planes. Adopt M-20 grade concrete and Fe-415 HYSD bars.  
 (10 Marks)

**OR**

- 10 Design a reinforced concrete footing for a rectangular column of section 300 × 500mm  
 supporting an axial factored load of 1500kN. The safe bearing capacity of the soil at site is  
 185kN/m<sup>2</sup>. Adopt M<sub>20</sub> Grade concrete and Fe -415 HYSD bars. (20 Marks)

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