



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

Max. Marks: 100

- 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. Briefly explain the principles of limit state. (08 Marks)  
b. Enlist the reasons for adopting partial safety factors for loads and material strength. (04 Marks)  
c. Explain short term deflection and long term deflection. (08 Marks)

OR

- 2 a. What is stress block? Derive from the fundamentals the expressions for the area of stress block  $0.36 f_{ck} b x_u$  and depth of centre of compressive force from the extreme fibre in compression  $0.42 x_u$ . (10 Marks)  
b. A simply supported RCC beam of size 300mm × 600mm carries a UDL live load of 25 kN/m and superimposed load [Dead load] 12 kN/m over an effective span of 5m. It is reinforced with 4#16mm diameter bars. The effective cover is 50mm. Calculate the short term deflection and long term deflection of beam, if  
(i) Ultimate shrinkage co-efficient = 0.0003, (ii) Creep co-efficient = 1.6,  
Concrete grade  $M_{20}$  and Steel Fe-415 are used. (10 Marks)

**Module-2**

- 3 a. Differentiate between under reinforced, over reinforced and balanced reinforced section. (06 Marks)  
b. A doubly reinforced beam section 250mm wide and 500mm deep to the centre of the tensile reinforcement. It is reinforced with 3#16mm diameter bars as compression reinforcement at an effective cover of 50mm and 4# of 20mm diameter as tension reinforcement. Determine the moment of resistance of the section.  $M_{20}$  concrete and Fe-500 steel is used. (14 Marks)

OR

- 4 a. A singly reinforced concrete beam 250mm × 450mm deep upto the centre of reinforcement is reinforced with 3 #16mm at an effective cover of 50mm, effective span 6m,  $M_{20}$  concrete and Fe 415 steel. Determine the central point load that can be supported in addition to the self weight. (10 Marks)  
b. Determine the moment of resistance of a T-beam for the following data:  
Breadth of flange = 740 mm,  
Effective depth = 400mm  
Breadth of web = 240 mm  
Area of steel ( $A_{st}$ ) = 5#20mm $\phi$  and  
Depth of flange = 110 mm  
Adopt  $M_{20}$  grade concrete and Fe-415 steel (10 Marks)

**Module-3**

- 5 Design a reinforced concrete beam of rectangular cross-section using the following data:  
Effective span = 5 m, width of beam = 250 mm, overall depth = 500 mm, service load including dead load and live load = 40 kN/m, tension cover = 50mm. Adopt M<sub>20</sub> grade concrete and Fe-415 steel. Sketch the reinforcement details. (20 Marks)

OR

- 6 Design one of the intermediate T-beam for a hall measuring 7m × 12m with beams spaced at 3m c/c. Depth of slab is 120mm. Level load on slab is 9.5 kN/m<sup>2</sup> including finishes. Use M<sub>20</sub> grade concrete and HYSD bars. (20 Marks)

**Module-4**

- 7 Design RCC slab for an office floor 4.5m × 5.5m with all four edges discontinuous and corners held down. The liveload on the slab is 3 kN/m<sup>2</sup>. Assume floor finish as 0.6 kN/m<sup>2</sup> and ceiling finish as 0.4 kN/m<sup>2</sup>. Use M<sub>20</sub> concrete and Fe-415 steel. Sketch the reinforcement details. (20 Marks)

OR

- 8 The clear dimension of a staircase hall is 2.4m × 4.75m. The floor to floor height is 3.52m. A two flight dog legged stair is to be provided between the two floors with a rise of 160mm. Design the stairs and also check for deflection, sketch the reinforcement details of any one of the flight. (20 Marks)

**Module-5**

- 9 a. Design the reinforcement of a square column if size 450mm × 450mm to support a service load of 1500 kN. Use M<sub>20</sub> concrete and Fe-415 steel. (10 Marks)  
b. A column size 300mm × 400mm has an effective length of 3.6m and is subjected to P<sub>u</sub> = 1100 kN and M<sub>u</sub> = 150 kN-m, about the major axis. Assuming the bars on two sides, design the column using M<sub>25</sub> concrete and Fe-415 steel. (10 Marks)

OR

- 10 Design a rectangular footing of flat type for a column of size 300mm × 500mm carrying an axial load of 1200 kN. SBC of soil is 200 kN/m<sup>2</sup>. Adopt M<sub>20</sub> concrete and Fe-500 steel. Sketch the reinforcement details. (20 Marks)

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