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10CV52

**Fifth Semester B.E. Degree Examination, July/August 2022**  
**Design of RCC Structural Elements**

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, selecting at least TWO full questions from each part.  
 2. Use of IS456-2000 and SP-16 permitted.  
 3. Assume any missing data suitably.

**PART – A**

1.
  - a. Explain balanced section and under reinforced section with the help of neat sketches in limit state RCC design. **(04 Marks)**
  - b. Explain the characteristic values and design values for loads and materials. **(04 Marks)**
  - c. Determine the moment of resistance of a singly reinforced R.C. beam of size 250mm × 500mm overall depth. The beam consists of 3 numbers of 18mm HYSD bars in the tension zone. Use M-20 concrete and Fe-415 grade steel. Also calculate the safe superimposed load, the beam can carry over a simply supported span of 6m. Assume moderate exposure conditions. **(12 Marks)**
  
2.
  - a. What is a stress block? Derive from fundamentals the expressions for area of stress block  $0.36 f_{ck} x_u$  and depth of centre of compressive force from the extreme fiber in compression  $0.416x_u$ . **(08 Marks)**
  - b. Determine the uniformly distributed load, the beam can carry for a rectangular section 250mm × 550mm. The beam is simply supported over a span 5m. It consists of 3 bars of 18mm HYSD bars in tension and 2 bars of 16mm HYSD bars in compression and 2 legged 8mm HYSD bars of vertical stirrups at 250mm C/C. Use M20 concrete and Fe415 grade steel. Use moderate exposure condition. **(12 Marks)**
  
3.
  - a. What is development length? Find the development length for 20mm diameter TMT bars of grade Fe500 subjected to tension, if M20 grade concrete is used. **(04 Marks)**
  - b. Write a note on necessity of control of crack and factors influencing crack with in an RC beam. **(06 Marks)**
  - c. Check the deflection requirement for the following tee-beam continuous over 10m spans and having flange width of 1200mm, web width of 250mm and effective depth = 400mm, area of tension reinforcement =  $1500\text{mm}^2$ , area of compression reinforcement =  $960\text{mm}^2$ . Adopt Fe-415 grade HYSD bars. **(10 Marks)**
  
4. Design a cantilever beam for flexure and shear. The beam has an effective span of 3m and is subjected to an uniformly distributed load of 15kN/m along with 20kN concentrated load acting at free end. Adopt M-25 concrete and Fe-415 grade steel. **(20 Marks)**

**PART – B**

5. Design a slab for a room used for residential purpose. The internal dimensions of the room are 4m × 6m. The beam is simply supported all around over 230mm thick wall. All the four corners are prevented from lifting. Use mild exposure condition. Adopt M-20 grade concrete and Fe-415 grade steel. **(20 Marks)**



- 6 a. Design a circular column to carry an axial load of 2000kN. Adopt M25 grade concrete and Fe-500 grade steel. (10 Marks)
- b. Design the necessary reinforcement for RCC column of size 400 × 600mm. The column has to carry a factored load of 1800kN. Length of column is 5.50m. Use M20 grade concrete and Fe-415 grade steel. Sketch the details of reinforcement. (10 Marks)
- 7 A rectangular column of size 350mm × 550mm carries a service load of 1800kN. The safe bearing capacity of soil is 200kN/m<sup>2</sup>. Design a rectangular footing to support the column. Adopt M-25 concrete and Fe-415 grade steel. Also sketch the details of reinforcement. (20 Marks)
- 8 Design a second flight of a doglegged staircase with the following given data:  
Height between floors = 3.6m  
Riser = 150mm  
Tread = 250mm  
Live load = 3kN/m<sup>2</sup>  
Dimensions of staircase = 2.4m × 5.5m  
Assume stairs are to be supported on landing beams of width 250mm parallel to stairs. Adopt M-20 grade concrete and Fe-415 grade steel. Sketch the details of reinforcement. (20 Marks)

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