CBCS SCHEME

21CV53

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Design of RC 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, Sp-16 is permitted.*
3. *Assume suitable additional data, if necessary.*

Module-1

1   a. Distinguish between working stress and limit state method of RCC design. **(06 Marks)**
    b. Explain balanced, under-reinforced and over-reinforced section with sketches. **(06 Marks)**
    c. From fundamental, derive expression for the area of stress block $0.36f_{ck}x_n$. **(08 Marks)**

OR

2   a. Explain the factors that affect short and long term deflection. **(06 Marks)**
    b. A simply supported beam of rectangular section 200mm wide by 450mm overall depth is used over an effective span of 5m. The beam is reinforced with 3 bars of 16mm diameter of an effective depth of 420mm. the beam supports a live load of 10kN/m. Calculate short term deflection using M20 concrete and Fe 415 steel. **(14 Marks)**

Module-2

3   a. A singly reinforced beam of 250mm wide by 500mm effective depth is reinforced with 4 bars of 22mm diameter. Effective spa of beam is 6m. Assuming M20 grade concrete and Fe415 steel, determine the concentrated load at midspan that can be carried by the beam in addition to its self weight. **(12 Marks)**
    b. A T-beam of depth 450mm has a flange width of 1000mm and depth of 120mm. It is reinforced with 6 bars of 20mm diameter on tension side with a cover of 30mm. If M20 concrete and Fe415 steel are used, calculated moment of resistance of the beam. Take web width = 300mm. **(08 Marks)**

OR

4   a. A doubly reinforced beam section is of 250mm wide and 500mm deep to the center of the tensile reinforcement. It is reinforced with 2 bars of 16mm diameter as compression steel at an effective cover of 40mm and 4 bars of 25mm diameter as tensile steel. Using M20 grade concrete and Fe415 steel, calculate the factored moment of resistance. **(12 Marks)**
    b. Determine the area of tensile reinforcement required for T-beam having following details
       Effective flange width = 2400mm
       Depth of flange = 150mm
       Width of web = 300mm
       Effective depth = 750mm
       Working moment 800kN-m
       Type of concrete = M20 ; Type of steel = Fe415 MYSD bars **(08 Marks)**

Module-3

5   Design a cantilever beam of clear span 3.25m, service load is 15kN-m. Use M20 grade concrete and fe415 steel. Sketch the reinforcement details. **(20 Marks)**

OR

6   a. List the circumstances under which doubly reinforced beams are recommended.   (04 Marks)
    b. A RC beam in supported on two walls of 500mm thick, spaced at a clear distance of 6m. The beam carries a super imposed load of 30kN/m. Use M20 grade concrete and Fe415 steel. Design the beam for flexure and shear. Sketch the reinforcement detail.   (16 Marks)

Module-4

7   The slab of a residential building of size 4.3m × 6m is simply supported an all four sides on 230mm walls. Assuming an imposed load of $2kN/m^2$, and load due to finishes of $1.0kN/m^2$, design the floor slab. Use M25 concrete and Fe 415 steel. Assume mild exposure. Sketch the reinforcement details.   (20 Marks)

OR

8   Design one of the flights of a dog-legged staircase for an office building, given the following data :
    Height between floor = 3.2m, Riser = 160mm, Tread = 270mm, Width of flight = loading width = 1.25m, Live load = $5kN/m^2$, finishes load = $0.6kN/m^2$. Assume the stairs to be supported on 230mm thick masonry walls at the outer edges of the landing, parallel to the risers. Use M20 concrete and Fe 415 steel. Assume mild exposure conditions. Sketch the reinforcement details.   (20 Marks)

Module-5

9   a. What is the note of transverse reinforcement in columns? What are the codal provisions to design the transverse reinforcement?   (05 Marks)
    b. Design a short reinforced concrete column of rectangular section to carry an ultimate load of 600kN and ultimate moment of 100kN-m, acting about an exist bisecting the depth of the column. Assume the effective length of column is 4.5m. Width of the supported beam in 300mm. Use M20 concrete and Fe415 steel, provide equal steel on both tension and compression sides. Sketch reinforcement detail.   (15 Marks)

OR

10   Design an isolated footing for a square column of size 400mm × 400mm, supporting a service load of 2200kN. Assume SBC of soil as $250 \, kN/m^2$ at a depth of 1.5m below the ground. Use M20 concrete and Fe 415 steel for the footing. Sketch the reinforcement details.   (20 Marks)

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