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Fifth Semester B.E. Degree Examination, June/July 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 IS456-2000, SP-16 is permitted.
3. Assume any missing data suitably.

Module-1

1 a. Explain the difference between working stress and limit state method of design. **(08 Marks)**
   b. Write brief short notes on:
      i)   Partial safety factor for loads
      ii) Partial safety factor for material
      iii) Characteristic load
      iv) Characteristic strength. **(12 Marks)**

OR

2 a. Explain the terms balanced section, under reinforced and over reinforced section. **(06 Marks)**
   b. A simply supported beam of rectangular cross section 250mm × 450mm overall depth is used over an effective span of 4.0m. The beam is reinforced with 3 bars of 20mm diameter, Fe415 HYSD bars at an effective depth of 400mm. Two anchor bars of 10mm diameter bars are provided. The self weight of beam together with the dead load on the beam is 4kN/m service load on the beam is 10kN/m. Use M20 grade of concrete. Compute: i) Short term deflection ii) Long term deflection. **(14 Marks)**

Module-2

3 a. Derive from fundamentals the expression for the area of stress block $0.36f_{ck}\ x_4$. **(08 Marks)**
   b. A rectangular R.C. beam section 230mm × 500mm is used as a simply supported beam for an effective span of 6.0m. The beam consists of tensile reinforcement of 4000mm^2 and centre of the reinforcement is placed at 35mm from bottom edge. What total maximum udl can be allowed on the beam? Use M20 concrete and Fe415 grade steel. **(12 Marks)**

OR

4 a. Derive the moment of resistance equation for a singly reinforced rectangular section. **(10 Marks)**
   b. A RCC beam 250mm wide and 450mm deep is reinforced with 3nos of 20mm diameter bars of grade Fe-415 on the tension side with an effective cover of 50mm. If the shear reinforcement of 2 legged 8mm vertical stirrups at a spacing of 160mm centre to centre is provide at a section. Determine the design shear strength of the section. Assume M-20 concrete has been used. **(10 Marks)**

Module-3

5 Design a reinforced concrete beam of rectangular 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, effective cover = 50mm. Adopt M20 concrete and Fe-415 grade steel. Sketch the reinforcement details. **(20 Marks)**

OR

6   A T-beam slab floor has 125mm thick slab forming a part of tee beam. Which are 8.0m clear span? The end bearings are 450mm thick. Spacing of T beam is 3.5m c/c. The live load on the floor is $3kN/m^2$. Design one of the intermediate T beams. Use M-20 concrete and Fe-415 grade steel. **(20 Marks)**

Module-4

7   Design a reinforced concrete slab for a room of size 3m × 5m (clear). The slab is supported on a wall of 300mm thickness with corners held down. Two adjacent edges of the slab are continuous and other two edges discontinuous. The live load on slab is $3kN/m^2$. Assume floor finish of $1kN/m^2$. Use M20 grade concrete and Fe-415 grade steel sketch the reinforcement details. **(20 Marks)**

OR

8   Design a dog legged stair for an office building in a room measuring 2.8m × 5.8m clear vertical distance between the floor is 3.6m. The width of flight is to be 1.25m. Assume live load of $3kN/m^2$. Use M-20 concrete and Fe-415 grade steel. Assume the stairs are supported on 230mm at the outer edges of landing stairs. Sketch the reinforcement details. **(20 Marks)**

Module-5

9   a.   Design a short column of size 450mm × 600mm. The column is subjected to a factored load of 3000kN. Use M20 concrete and Fe415 grade steel. **(10 Marks)**

    b.   Design the reinforcement for a column of size 300mm × 400mm having an effective length of 2.5m. Moment about the major axis of the column is 100kN-m and axial load of 800kN. Use M25 concrete and Fe500 steel provide the reinforcement on two sides. **(10 Marks)**

OR

10   Design a square footing to carry a column load of 1200kN from a 400mm square column. The bearing capacity of soil is $120kN/m^2$. Use M20 concrete and Fe-415 grade steel. Sketch the reinforcement details. **(20 Marks)**

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