15CT/CV51

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

Time: 3 hrs.   Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS456:2000 and SP-16 is permitted.

Module-1

1   a. Explain the principles of limit state design.   **(06 Marks)**
     b. What is stress block? Derive from the fundamentals for the area of stress block $0.36 f_{ck} x_u$ and depth of centre of compressive force from the extreme fibre in compression $0.42x_u$.   **(10 Marks)**

OR

2   a. Explain short term deflection and long term deflection.   **(06 Marks)**
     b. A rectangular simply supported beam of span 5m is 300mm × 650mm in cross section and is reinforced with 3 bars of 20mm on tension side at an effective cover of 50mm. Determine the short term deflection due to an imposed working load of 20kN/m (including self wt). Assume grade of concrete M20 and grade of steel Fe415.   **(10 Marks)**

Module-2

3   a. Differentiate between under reinforced, over reinforced and balanced section.   **(06 Marks)**
     b. A single reinforced concrete beam of 250mm × 450mm deep upto to the centre of reinforcement is reinforced with 3-16 at an effective cover of 50mm, effective span 6m. M20 concrete and Fe415 steel. Determine the central point load that can be supported in addition to the self weight.   **(10 Marks)**

OR

4   a. A rectangular beam is 250mm wide and 500mm deep, is reinforced with 3 bars of 20mm diameter bars in compression zone. Determine the area of tension reinforcement needed to make the section fully effective. Also find the moment of resistance of section. Assume M20 grade concrete and Fe415 steel, cover the reinforcement is 50mm.   **(10 Marks)**
     b. Determine the moment of resistance of a 'T' beam for the following data:
        Breadth of the flange = 740mm, effective depth = 400mm, area of steel = 5-20 # and depth of flange = 110mm. Adopt M20 grade concrete and Fe415 steel.   **(06 Marks)**

Module-3

5   Design a reinforced concrete beam of rectangular cross section using the following data:
     Effective span = 5m, width of the beam = 250mm, overall depth = 500mm, service load including dead and live load = 40kN/m, tension cover = 50mm, adopt M20 grade concrete and Fe-415 grade steel. Sketch the reinforcement details.   **(16 Marks)**

OR

6 A T-beam slab floor has 125mm thick slab forming a part of T – beam, the end bearing are 450mm wide. Clear span is 8m. Spacing of T-beam is 3.5m centre to centre. Live load on floor is $3kN/m^2$. Design an intermediate beam. Use M20 concrete and Fe415 steel.

(16 Marks)

Module-4

7 Design a R.C.C. slab for an office floor 4.5m × 5.5m with all four edges discontinuous and corners held down. The live load on the slab is $3kN/m^2$. Assume floor finish as $0.6kN/m^2$ and ceiling finish as $0.4kN/m^2$. Use M20 concrete and Fe415 steel. Sketch the reinforcement details.

(16 Marks)

OR

8 Design a Dog legged staircase for a office building in a room measuring 2.8 × 5.8m clear. Vertical distance between the floors 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 that the stairs are simply supported on 230mm at the outer edges of landing slabs. Sketch the reinforcement details.

(16 Marks)

Module-5

9 a. A RCC column of size 300 × 300mm is reinforced with four bars of 16mm diameter. Determine the allowable service load on the column. M25 grade concrete and Fe500 steel is used.

(06 Marks)

   b. A column size of 300mm × 400mm has an effective length of 3.6m is subjected to factored load = 1100kN and factored bending moment about major axis = 150kNm. Assuming the bars on two sides. Design the column using M25 concrete and Fe415 steel.

(10 Marks)

OR

10 Design a rectangular footing of flat type for a column of size 300 × 500mm carrying an axial load of 1200kN. SBC of soil is $200kN/m^2$. Adopt M20 concrete and Fe500 steel. Sketch the reinforcement details.

(16 Marks)

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