Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Design of RCC Structural Elements

Time: 3 hrs.   Max. Marks:100

Note: 1.Answer any FIVE full questions, selecting atleast TWO questions from each part.
         2.Use of code IS-456-2000 and SP16 is permitted.
         3.Assume missing data, if any, suitably.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1   a.   Explain with the help of classical reliability model the following :
         (i)   Characteristic Load and Design Load
         (ii)   Characteristic Strength and Design strength of concrete and steel.   **(06 Marks)**
    b.   Distinguish between underreinforced section and overreinforced section with neat sketches.
                                                                (06 Marks)
    c.   Derive an expression for maximum depth of neutral axis and limiting percentage of steel for rectangular R.S. Section for M20 concrete and Fe415 grade steel.   **(08 Marks)**

2   a.   Determine the moment of resistance of a singly reinforced R.C. beam of size 250mm × 500mm overall. The beam consists of 3 – # 18 in the tension zone. Also calculate the superimposed live load the beam can carry over a simply supported span of 6m. Use M-20 concrete and Fe415 steel. Assume moderate exposure.   **(10 Marks)**
    b.   An R.C. beam of size 250×500mm overall is reinforced with 5 – # 25mm bars in tension and 5 – # 12mm bars in compression with a clear cover of 25mm. Effective span of the beam is 4m. Determine the ultimate moment of resistance of the section.   **(10 Marks)**

3   a.   What are the major factors that influence crack width in R.C. beams?   **(04 Marks)**
    b.   What is development length? Calculate development length in tensions for M-20 grade concrete and Fe415 grade steel.   **(04 Marks)**
    c.   A T beam slab floor consists of 150mm thick slab (R.C. slab) monolithic with 300mm wide beams. The beams are spaced at 3.5m c/c. The effective span of the beam is 6m. The superimposed load on the slab is 05 kN/m^2. Calculate the area of flexural steel required.
                                                                      (12 Marks)

4   Design a cantilever beam for flexure and shear, if its effective span is 3m. The beam is subjected to an udl of 15 kN/m along with 20 kN at free end. Check for deflection. Materials used are M25 and Fe415 grade concrete and steel respectively. Assume Moderate Exposure condition.   **(20 Marks)**

PART – B

5   Design a slab over a room of internal dimension 4m × 5.5m supported on 230mm thick brick wall. Consider Live Load = $2kN/m^2$ and floor finish = 1 kN/m^2. The corners are free to be lifted up. Use M20 grade concrete and Fe415 grade steel.   **(20 Marks)**

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6 a. Design a circular column to carry an axial load of 2000 kN. Use M25 grade concrete and Fe500 grade steel. **(08 Marks)**

b. Design a short rectangular column subjected to an axial load of 3000 kN. Take effective length = 3.0m. M20 Concrete and Fe415 steel are used. Check for minimum eccentricity. **(12 Marks)**

7 A rectangular column of size 350mm × 550mm carries a live load of 1800 kN. The safe bearing capacity of soil is 200 kN/m^2. Design a rectangular footing to support the column. Sketch the details of reinforcement. M25 concrete and Fe415 steel are used. **(20 Marks)**

8 Design a second flight of a doglegged staircase given the following details:
Height between floors = 3.6m, Rise = 150 mm, Tread = 250mm, Imposed Load = 3 kN/m^2. Dimension of staircase = 2.4m × 5.5 m. Assume stairs are to be supported on landing beams of width 250mm parallel to stairs. Use M-20 concrete and Fe415 steel. Sketch the details of reinforcement. **(20 Marks)**

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