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10CV/CT52

Fifth Semester B.E. Degree Examination, June/July 2015
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 IS456-2000 and SP-16 is permitted.
3. Assume missing data, if any, suitably.

PART – A

1 a. What is meant by normal distribution in statistics and what is the relationship between mean value and characteristic value in such distribution assuming 5% confidence limit? **(05 Marks)**

b. Derive an expression for limiting values of x_u/d ratio from basic for different grades of steel used in RCC beam design. What is their importance? **(05 Marks)**

c. For a given data of a beam subjected to bending show that $\frac{x_u}{d} = 1.2 - \sqrt{(1.2)^2 - \left(\frac{6.68M_u}{fck\, bd^2}\right)}$. Data: b, d M_u, f_{ck} and f_y. **(05 Marks)**

d. Explain the terms balanced, over-reinforced and under reinforced section in beam subjected to flexure with neat sketches. Which of these should be recommended in design? And why? **(05 Marks)**

2 a. Determine the flexural steel reinforcement at mid span for a simply supported beam of effective span of 5.25m. The characteristic dead and live loads shall be 15kN/m and 20 kN/m respectively. The cross sectional dimensions are width is 300mm and effective depth is 675mm. Adopt M_{20} grade concrete and Fe415 grade steel. **(10 Marks)**

b. A RC beam of section 250mm × 500mm overall dimension is reinforced with 5 bars of 25mm diameter on tension side and 5 bars of 12mm diameter on compression side with an effective cores of 50mm for both. Determine the ultimate moment of resistance of the section. Adopt M_{25} grade concrete and Fe415 grade steel. **(10 Marks)**

d^1/d	0.15	0.10
Fe415, fsc	342 N/mm^2	353 N/mm^2

3 a. Determine the ultimate shear strength of the support section of a RC beam with following data: width, b = 300mm, effective depth, d = 600mm, A_{st} = 4 bars of 25mm ϕ, 8mm ϕ 2 legged vertical stirrups at 150mm c/c, 2 bars of 25mm ϕ are bentup at 45° near the support. Adopt M_{25} grade concrete and Fe415 grade steel. **(10 Marks)**

b. Determine the ultimate moment of resistance of flanged beam as shown in Fig.Q.3(b). Adopt M_{20} grade concrete and Fe415 grade steel. **(10 Marks)**

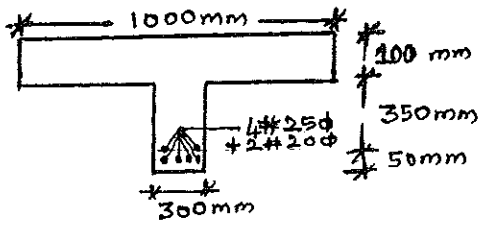

Fig.Q.3(b)

4 A simply supported RC beam supports a service live load of 8 kN/m over a clear span of 3m. Support width is 200mm. Adopt M_{20} grade concrete and Fe415 grade steel. Design the beam for flexure and shear. Check the beam depth for control of deflection using empirical method. Sketch the reinforcement details. **(20 Marks)**

PART – B

5 Design a two way slab of 5m × 7m (clear dimensions) with all four edges discontinuous and corners held down. The slab has a support width of 300mm on all the four edges. The live load on the slab is 3kN/m^2. Adopt M_{25} grade concrete and Fe415 steel grade. Sketch the reinforcement details. **(20 Marks)**

6 a. Design a circular pin ended column of 400mm diameter with helical reinforcement, with unsupported length of 4m. The column is to carry a factored axial load of 1500kN. Adopt M_{20} grade concrete and Fe415 grade steel. Sketch the reinforcement details. **(10 Marks)**

b. ARC column of size 300mm × 400mm has an unsupported length of 3m and effective length 3.6m. Determine the longitudinal steel and transverse steel if the column is subjected to a factored load of P_u = 1000 kN and M_u = 210 kN-m. Adopt M_{25} grade concrete and Fe415 grade steel. Assume d′ = 60mm. Sketch the reinforcement details. **(10 Marks)**

7 Design an isolated rectangular footing of uniform depth for the column size of 230mm × 300mm supporting an axial service load of 850kN-m. The safe bearing capacity of soil is 150kN/m^2. Adopt M_{20} grade concrete and Fe415 grade steel. Sketch the reinforcement details. **(20 Marks)**

8 Design a dog legged staircase for a building in which the vertical distance between floors is 3.5m. The stair hall measures 2.1m × 5.0m. Take live load of 2 kN/m^2. The flights are supported on 230mm walls at the ends of outer edges of landing slab, so that it spans in the direction of going. Adop M_{20} grade concrete and Fe415 grade steel. Sketch the reinforcement details. **(20 Marks)**

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