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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Civil Engineering

Semester End Examination; Feb. - 2021

Design of RC Structural Elements

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Explain characteristic values and design values for loads and materials. 4

b. Explain limit state method of design of RCC members. 6

c. Derive from fundamentals the expressions for area of stress block 0.36 f_{ck} x_u and depth of center of compressive force from the extreme fibre in compression 0.42 x_u. 10

2 a. Explain in detail the necessity of considering partial safety factor in the limit state method of design. 5

b. A rectangular beam of span 6 m, width 250 mm is having effective depth of 300 mm. The concrete grade is M20 and the grade of reinforcing steel is Fe415. The tensile reinforcement is provided by 2 –# 16 bars. As per limit state method, compute the moment of resistance and load carrying capacity of the beam. 15

UNIT - II

3 a. Determine the moment of resistance of the beam with A_{st} as (4–#25 and 2–#20), b_f = 1000 mm, D_f = 100 mm, b_w = 300 mm, cover = 50 mm and d = 450 mm. Use M20 and Fe415. 8

b. Determine the shear reinforcements of the cross section as shown in Fig. Q 3b. Factored shear force is 250 kN, use M20 and Fe415. 12

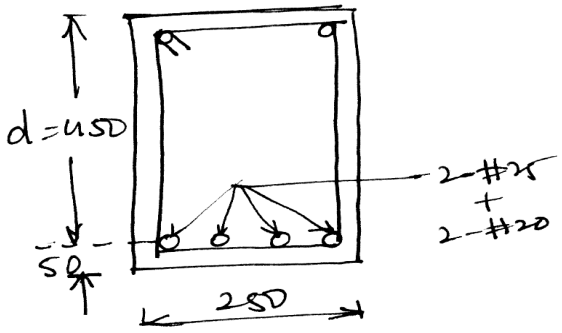

Fig. Q 3b

4 a. A reinforced concrete rectangular beam b = 300 mm, d = 600 mm and D = 650 mm is subjected to factored shear force V_u = 70 kN in one section. Assuming the percentage of tensile reinforcement as 0.5 in that section, determine the factored torsional moment that the section can resist. If, i) No additional reinforcement for torsion is provided 10

ii) Maximum steel for torsion is provided at that section

Assume M30 grade concrete.

Contd…2

b. A rectangular beam of width 300 mm and overall depth 450 mm is subjected to a factored shear of 350 kN. The tension side is provided with 4 – 20 mm dia bars. Assuming M25 grade of concrete, clear cover as 25 mm and Fe415 steel. Comment on the shear design requirement of the beam. 10

UNIT - III

5. Design a simply supported beam of effective span 8 m subjected to imposed loads of 35 kN/m. The beam dimensions and other data are, b = 300 mm, D = 700 mm, M20 concrete, Fe415 steel. Sketch the details of reinforcement. 20

6. Design a simply supported beam supporting a slab of 100 mm thick, spacing of the beams = 4000 mm c/c, effective span = 10 m and imposed loads on slab = 4 kN/m^2. Use M25 and Fe500. 20

UNIT - IV

7. Design a floor slab 7 × 5 m, clear dimensions supporting on all four sides by 230 mm thick brick walls. Slab is subjected to LL = 4 kN/m^2, floor finish = 1 kN/m^2, M20, Fe415. Sketch the sebar plan details. 20

8. Design the dog legged stair case supported at the junction of landing and going on 300 mm wide beams such that landing slab are cantilevers. Floor finish = 1 kN/m^2, live load = 5 kN/m^2, riser R = 160 mm, tread T = 270 mm, M20 and Fe415. Draw sectional elevation of one flight. 20

UNIT - V

9 a. Determine the reinforcement required for a column 300 × 500 mm, subjected to a factored axial load of 1600 kN and factored moment = 120 kN-m about major axis is M20 and Fe415. 10

b. Design a column (400 × 600 mm) subjected to factored axial load P_a = 2000 kN, and factored moments M_{ux} = 160 kN-m, M_{uy} = 120 kN-m, M20 and Fe415. 10

10. Design an isolated footing for a square column 400 mm × 400 mm with 12 - 20 mm diameter longitudinal bars carrying service loads of 1500 kN with M20 and Fe415. The safe bearing capacity of soil is 250 kN/m^2, at a depth of 1 m below the ground level. Use M20 and Fe415. Draw the plan and sectional deviation. 20

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