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Second Semester B.Arch. Degree Examination, July/August 2021 Building Structures – II

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. From first principle derive the centroid of a rectangle. (05 Marks)
 b. Locate the centroid for the composite section shown below. (Ref Fig. Q1 (b)) (07 Marks)

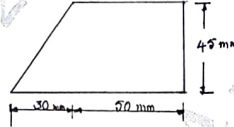


Fig. Q1 (b)

- c. For the shaded area shown below, locate the centroid (semicircle cut from rectangle). (08 Marks)

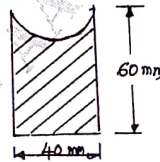


Fig. Q1 (c)

- 2 a. What is moment of inertia? Explain the significance of moment of inertia for beams and columns. (06 Marks)
 b. For the T-section shown below in Fig. Q2 (b), determine moment of inertia about centroidal X-X and Y-Y axes and hence find least radius of gyration. (14 Marks)

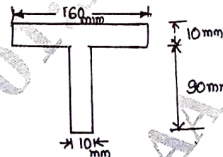


Fig. Q2 (b)

- 3 a. Define : (i) Shear force (ii) Bending moment (iii) Point of contraflexure. (06 Marks)
 b. For the Cantilever beam shown below in Fig. Q3 (b), determine shear force and bending moment at all the salient points. Draw SFD and BMD. (06 Marks)

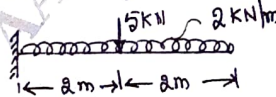


Fig. Q3 (b)

- c. Draw shear force and bending moment diagram for the simply supported beam shown below in Fig. Q3 (c). Also find maximum bending moment. (08 Marks)

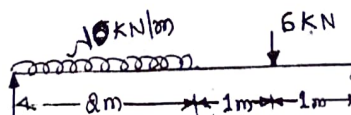


Fig. Q3 (c)

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.

- 4 An overhanging beam is subjected to forces as shown below in Fig. Q4. Draw SFD and BMD and indicate all the salient points. (20 Marks)

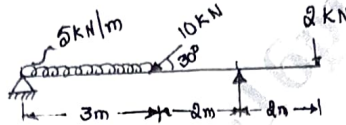


Fig. Q4

- 5 a. Write pure bending theory equation and explain all the terms. (05 Marks)
 b. What is section modulus? Calculate the section modulus for the hollow section shown below: (05 Marks)

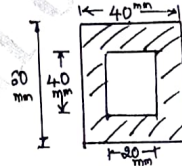


Fig. Q5 (b)

- c. A rectangular cross section beam of dimension 60mm × 120mm and length 3 m is simply supported at the ends. The beam is subjected to an udl of 9 kN/m throughout the beam. Determine bending stress and draw bending stress diagram. (10 Marks)
- 6 a. Draw the typical variation of shear stress along the depth of beam for, (i) Rectangular cross section (ii) T-section. (08 Marks)
 b. Explain slope and deflection of a beam with neat sketch for a simply supported beam and a cantilever beam. (05 Marks)
 c. Determine maximum slope and deflection for the simply supported beam shown below in Fig. Q6 (c) using standard formula. (07 Marks)

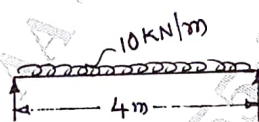


Fig. Q6 (c)

$$E = 2 \times 10^5 \text{ N/mm}^2$$

$$I = 86 \times 10^5 \text{ mm}^4$$

- 7 a. Define (i) Column (ii) Slenderness ratio (iii) Effective length of column. (06 Marks)
 b. Calculate the safe buckling load on a hollow column of 200 mm external diameter and thickness 20 mm. The length of the column is 5 mts. Use Euler's formula with factor of safety = 4, $E = 2 \times 10^5 \text{ N/mm}^2$. When (i) Both ends hinged. (ii) One end fixed and the other hinged. (14 Marks)
- 8 a. What are the assumptions made while deriving Euler's Buckling load formula? (05 Marks)
 b. Determine the buckling load for a T-section column of flange width 100 mm and overall depth 80 mm. Thickness of both flange and stem 10 mm. The column is 4 mts long and hinged at both ends. Take $E = 2 \times 10^5 \text{ N/mm}^2$. (15 Marks)
- 9 a. A concrete column with square section 250mm × 250mm consists of '4' steel bars, each of diameter 16 mm. Determine the stresses induced in steel and concrete, when the column is subjected to a load of 300 kN. Take $E_s = 200 \text{ GPa}$, $E_c = 14 \text{ GPa}$. (10 Marks)
 b. A square Reinforced axially loaded column is 300mm × 300mm. The effective length of column is 3 m. With '6' bars of 16 mm diameter. The grade of concrete is M₂₀. Determine the strength of column with steel grade Fe415. (10 Marks)
- 10 The cross section of a rectangular column is 250mm × 400mm with 8 vertical 16 mm dia bars. Determine the strength of column for the given stresses in steel and concrete, (i) M₂₀ and Fe415. (ii) M₂₅ and Fe500 (iii) M₁₅ and Fe250 (20 Marks)