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Question Paper Code: E3047

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2010

Fourth Semester

Civil Engineering

CE2252 — STRENGTH OF MATERIALS

(Regulation 2008)

Time: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A — (10 × 2 = 20 Marks)

1. A beam of span 4 m is cantilever and subjected to a concentrated load 10 kN at free end. Find the total strain energy stored. Take the Flexural rigidity is EI.

2. Write down Maxwell's reciprocal theorem.

3. A fixed beam of span 'L' is subjected to UDL throughout w/m. What is end moments and moment at the centre?

4. Draw BMD for a propped cantilever beam span 'L' subjected to UDL throughout w/m.

5. Define core of a section and draw the same for a circular section.

6. Write Rankine's equation for column.

7. Define principal plane and principal stress.

8. State the principal stress theory of failure.

9. What is 'fatigue strength' and 'endurance ratio' in a fatigue testing of material?

10. Write the Winkler-Bach formula for a curved beam.

PART B — (5 × 16 = 80 Marks)

11. (a) For the beam shown in Fig. 1, find the deflection at C and slope at D

$I = 40 \times 10^7 \text{ mm}^4$

E = 200 GPa. (16)

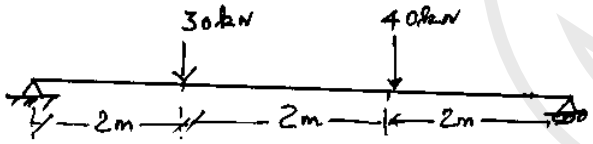

Fig. 1

Or

(b) For the truss shown in Fig. 2, find the horizontal movement of the roller at D AB, BC, CD area = 8 cm^2

AD and AC = 16 cm^2

$E = 2 \times 10^5 \text{ N/mm}^2$. (16)

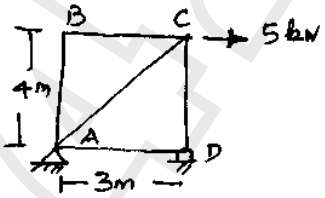

Fig. 2

12. (a) For the fixed beam shown in Fig. 3, draw the SFD and BMD. (16)

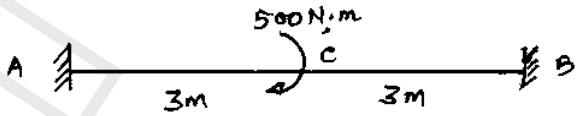

Fig. 3

Or

(b) For the continuous beam shown in Fig. 4, draw SFD and BMD all the supports are at same level. (16)

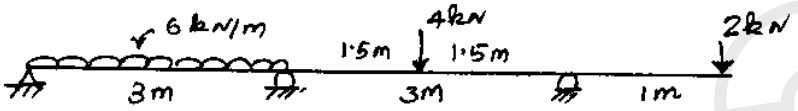

Fig. 4

13. (a) (i) Derive the Euler's equation for column with two ends fixed. (8)

(ii) A circular bar of uniform section is loaded with a tensile load of 500 kN. The line of action of the load is off the axis of the bar by 10 mm. Determine the diameter of the rod, if permissible stress of the material of the rod is 140 N/mm^2. (8)

Or

(b) Find the greatest length of a mild steel rod of 30 mm × 30 mm which can be used as a compressive member with one end fixed and the other end hinged. It carries a working load of 40 kN. Factor of safety = 4, $\alpha = 1/7500$ and $\sigma_c = 300\ N/mm^2$. Compare the result with Euler. $E = 2 \times 10^5\ N/mm^2$. (16)

14. (a) (i) Briefly explain spherical and deviatory components of stress tensor. (6)

(ii) Explain the importance of theories of failure. (4)

(iii) For the state of stress shown in Fig. 5, find the principal plane and principal stress. (6)

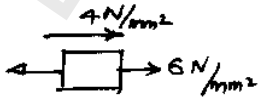

Fig. 5

Or

(b) A circular shaft has to take a bending moment of 9000 N.m and torque 6750 N.m. The stress at elastic limit of the material is $207 \times 10^6\ N/m^2$ both in tension and compression. $E = 207 \times 10^6$ KPa and $\mu = 0.25$. Determine the diameter of the shaft, using octahedral shear stress theory and the maximum shear stress theory. Factor of safety : 2. (16)

15. (a) A rectangular simply supported beam is shown in Fig. 6. The plane of loading makes 30° with the vertical plane of symmetry. Find the direction of neutral axis and the bending stress at A. (16)

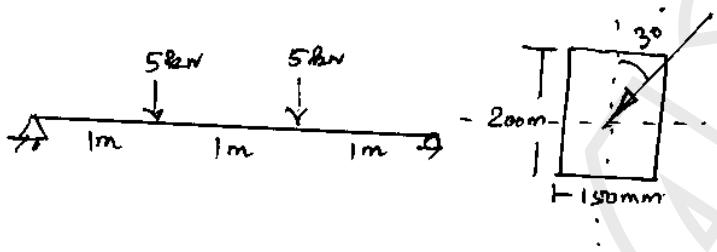

Fig. 6

Or

(b) A curved bar of rectangular section, initially unstressed is subjected to bending moment of 2000 N.m tends to straighten the bar. The section is 5 cm wide and 6 cm deep in the plane of bending and the mean radius of curvature is 10 m. Find the position of neutral axis and the stress at the inner and outer face. (16)

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