B 2105

B.E/B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Fourth Semester

Mechanical Engineering

CE 251 — STRENGTH TO MATERIALS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Strain.

2. Define bending moment at a section of the beam.

3. What is point of contraflexure?

4. Draw the shear stress variation in an I Section qualitatively.

5. Write the expression for the polar moment of inertia of hollow circular section.

6. Define proof load of springs.

7. Write the expressions for hoop stress and longitudinal stress when a thin cylinder is subjected to an internal fluid pressure of 'P'.

8. Draw the qualitative deflected curve for the following cantilever beam (fig. 8)

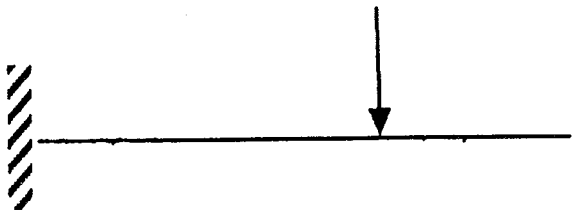

Fig. (8)

9. Draw the conjugate beam for the overhanging beam shown in fig.9

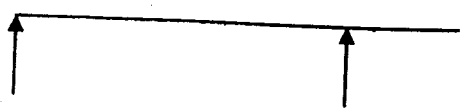

Fig. (9)

10. State Castigliano's first theorem.

PART B — (5 × 16 = 80 marks)

11. (a) A bar ABCD of steel is 600 mm long and the two ends AB and CD are respectively 30 mm and 40 mm in diameter and each is 150 mm in length, the middle portion BC being 25mm in diameter. Determine the final length of the bar when subjected to an axial compressive load of 120 kN. $E = 2.1 \times 10^5$ N/mm^2.

Or

(b) Draw the shearing force and bending moment diagrams for the beam shown in figure 11(b).

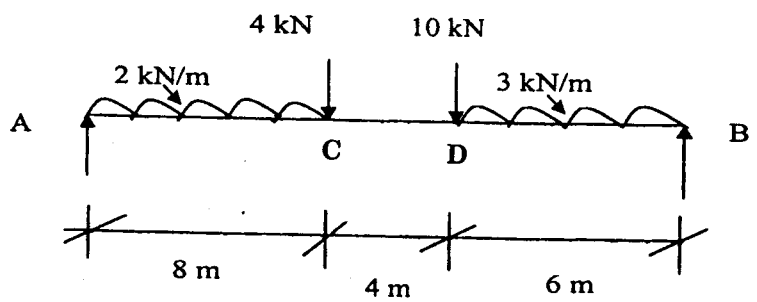

Fig. (11 b)

12. (a) Draw the BM and SF diagrams for the overhanging beam carrying loads as shown in fig. 12(a).

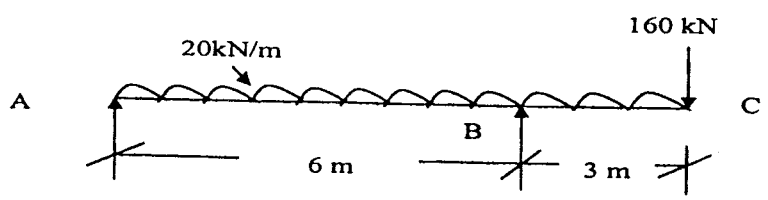

Fig. (12 a)

Or

(b) A test beam 30mm square in section is broken by a load of 1200 N applied at the centre of span 1.0m. Using a factor of safety of 8, calculate the safe uniformly distributed load for a beam 110 mm wide and 300 mm deep freely supported over a span of 4.5m.

13. (a) Two wooden planks 50 x 150 mm each are connected together to form a cross section of a beam as shown in fig. 13(a). If a bending moment of 3400 Nm is applied around the horizontal neutral axis, find the stresses at the extreme fibres of the cross section. Assume tension below the neutral axis. Also calculate the total tensile force on the cross section.

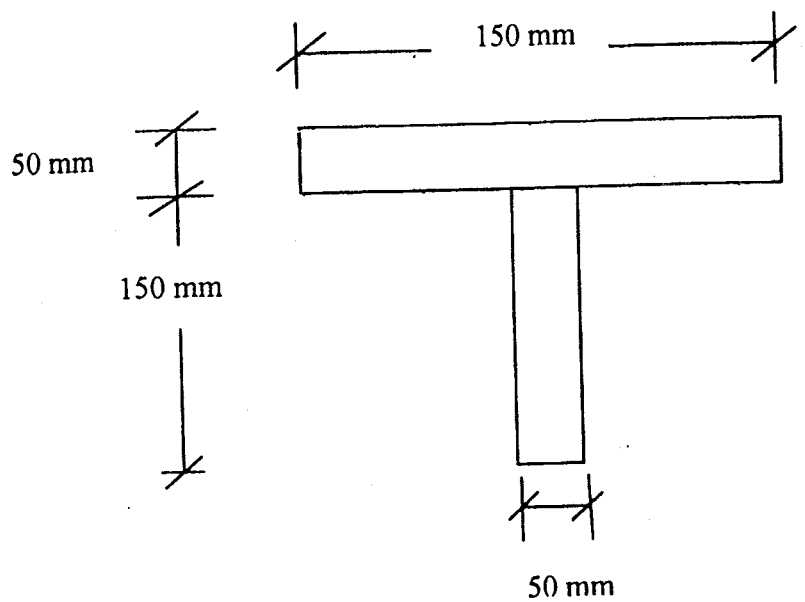

Fig. 13 (a)

Or

(b) In a tensile test on a steel specimen 12 mm diameter and 140 mm long between gauge points, the elongation was found to be 5.89×10^{-2} mm when a load of 10kN was applied. In a torsion test on the same specimen the angle of twist was found to be 0.47°on a length of 140mm under a twisting moment of 10kN mm. From these data calculate the values of Young's modulus, Poisson's ratio and modulus of rigidity.

14. (a) A cylindrical vessel composed of thin plates of 20 mm thick has a diameter of 1200mm, its end being hemispherical. Estimate the thickness of the ends in order that the circumferential strain may be the same in the ends as the cylindrical shell, and state the stress in the ends when the internal pressure is 1 N/mm^2. Poisson's ratio =0.25.

Or

(b) A beam of uniform cross section 10 m long is freely supported at its ends and loaded with 10 kN at points 3 m from each end. Find the ratio of central deflection to that under each load.

15. (a) Case a: A horizontal beam is simply supported at two points l apart and overhangs b on both sides. There is concentrated load W at each end of the beam. Find the upward deflection at the middle of the beam.

Case b: Another similar overhanging beam carries only a central load 2W.

Prove that the upward deflection at each overhanging end would be the same as the central deflection in Case a. The material and cross section of the two beams are identical. Use moment area theorems.

Or

(b) Calculate the end slope and central deflection of a simply supported beam of span L and subjected to a central concentrated load using Castigliano's theorem.
