J 1080

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Third Semester

Civil Engineering

CE 231 — MECHANICS OF SOLIDS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define : Strength and Stiffness.

2. State the relation between (a) E and G and (b) E and K.

3. Define (a) Shear force and (b) Bending moment at a section.

4. What is point of contraflexure? In which beam will it occur?

5. Derive the relation between shear force and bending moment, in bending theory.

6. Draw the shear stress distribution diagram for a rectangular section and indicate the maximum value.

7. Define stiffness of a helical spring and write an expression for it.

8. Derive an expression for the longitudinal stress in a thin cylinder subjected to internal pressure.

9. What is the expression for a normal stress on an inclined plane in a block which is subjected to two mutually perpendicular normal stresses and shear stresses.

10. A point load is applied at the free end of a cantilever. Find the maximum slope and deflection by moment area method.

PART B — (5 × 16 = 80 marks)

11. Draw the SF and BM diagram for the beam shown in Fig. Q. 11. Find the maximum values and their position. Give the values at important points in the diagram

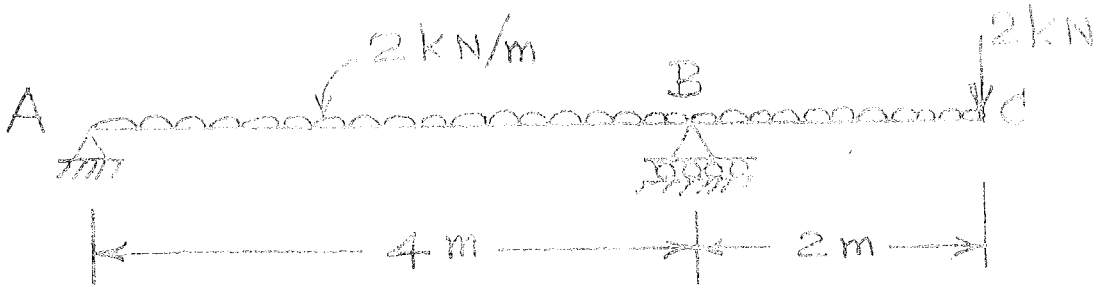

Fig. Q. 11

12. (a) A bar 30 mm × 30 mm × 250 mm long was subjected to a pull of 90 kN in the direction of its length. The extension of the bar was found to be 0.125 mm, while the decrease in each lateral dimension was found to be 0.00375 mm. Find the Young's modulus, Poisson's ratio, modulus of rigidity and bulk modulus for the material of the bar.

Or

(b) Determine the forces in all the members of the truss shown in Fig. Q 12(b).

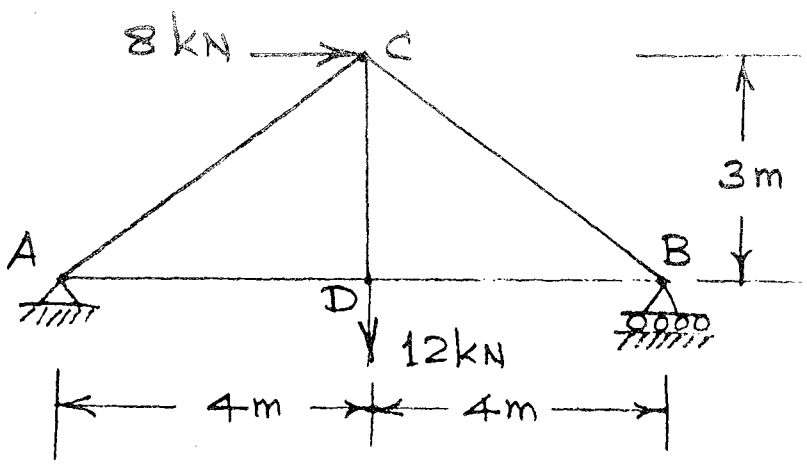

Fig. Q 12(b).

13. (a) A timber beam 150 mm wide and 300 mm deep is simply supported over a span of 4 m. Find the maximum uniformly distributed load that the beam can carry, if the bending stress is not to exceed 8 N/mm^2.

Or

(b) A point in a strained material is subjected to a horizontal tensile stress of 80 N/mm^2 and a vertical compressive stress of 100 N/mm^2. It is also accompanied by a shear stress of 50 N/mm^2. Determine the principal stresses, principal planes, the maximum shear stress and its planes.

14. (a) Determine the diameter of a solid shaft transmitting 300 kN at 250 rpm. The maximum shear stress should not exceed 30 N/mm^2 and the twist should not be more than 1° in a shaft length of 2 m. G = 100 kN/mm^2.

Or

(b) A close coil helical spring of round steel wire 10 mm in diameter has a mean diameter of 120 mm. The spring has 10 complete turns and is subjected to an axial load of 200 N. Determine

(i) the deflection of the spring

(ii) maximum shear stress in the wire and

(iii) stiffness of the spring. G = 80 kN/mm^2.

15. (a) A simply supported beam of span 10 m carries point loads of 100 kN and 60 kN at distances of 2 m and 5 m, respectively from the left support. Find the deflection at the centre of the beam. E = 200 kN/mm^2, I = 18 × 10^8 mm^4. Use Macaulay's method.

Or

(b) A cantilever of length '2a' carries two point loads of W at a distance 'a' and '2a' from the fixed end. Find the maximum slope and deflection. Use moment area method.

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