N 1174

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Second Semester

Electrical and Electronics Engineering

CE 151 — SOLID MECHANICS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define tension coefficient.

2. What are redundant frames?

3. Derive the relationship between young's modulus and bulk modulus.

4. Define principle planes.

5. Derive the relationship between shear force and bending moment.

6. What is meant by point of contraflexure?

7. What is the section modulus for a hollow circular section?

8. Draw bending and shear stress distribution for a 'T' section.

9. Write down the formula for deflection of a open coiled helical spring subjected to a downward axial load 'w'.

10. Derive a relation for torsional moment carrying capacity of a solid circular shaft.

PART B — (5 × 16 = 80 marks)

11. Draw the shear force and bending moment diagrams for the following beams (Fig. Q. 11 (i) and Q. 11 (ii)). (12)

(i)

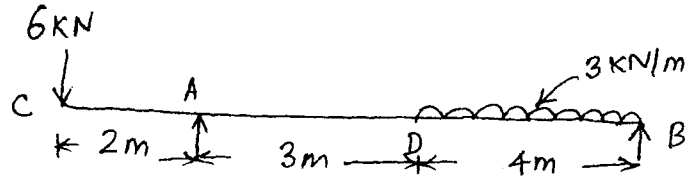
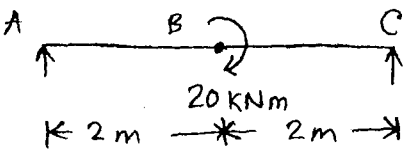


Fig. Q. 11 (i)

(ii)



(4)

Fig. Q. 11 (ii)

12. (a) Find the forces in the members of the truss shown in fig. Q. 12 (a) by method of joints.

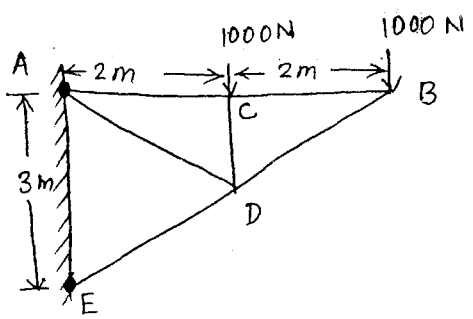


Fig. Q. 12 (a)

Or

(b) A bar 250 mm long, cross sectional area 100 mm × 50 mm, carries a tensile load of 500 kN along lengthwise, a compressive load of 5000 kN on its 100 mm × 250 mm faces and a tensile load of 2500 kN on its 50 mm × 250 mm faces. Calculate (i) the change in volume (ii) what change must be made in the 5000 kN load so that no change in the volume of bar occurs.

13. (a) A load of 50 kN is suspended by a steel pipe of 50 mm external diameter. If the ultimate tensile strength of steel is 500 N/mm^2 and the factor of safety is 4, determine (i) the thickness of the pipe (ii) elongation of the pipe over a length of 200 mm if stressed to its maximum permissible value. Take E = 200 kN/mm^2.

Or

(b) Draw shear force diagram and bending moment diagram and find the maximum bending moment for the beam given in Fig. Q. 13 (b).

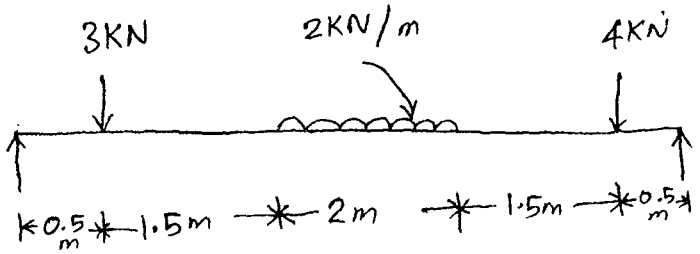


Fig. Q. 13 (b)

14. (a) A vertical power transmission pole is 6 m hing, square section 280 mm × 280 mm at bottom and 140 mm × 140 mm at top. A horizontal pull of 8 kN applied through the geometric centre of the section. Find the position and magnitude of maximum bending stress.

Or

(b) A beam of 'T' section shown in Fig. Q. 14 (b) is subjected to a shear force 20 kN. Find the maximum shear stress intensity and draw the shear stress distribution diagram.

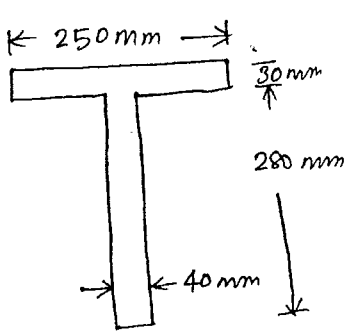


Fig. Q. 14 (b)

15. (a) A solid shaft is subjected to a torque of 100 Nm. Find the necessary diameter of the shaft if the allowable shear stress is 100 N/mm^2 and the allowable twist is 3° per 10 diameters length of the shaft. Take $C = 1 \times 10^5$ N/mm^2.

Or

(b) An open coiled helical spring is subjected to an axial load of 50 kN. Determine the deflection of the spring and maximum shear stress in the spring wire the spring particulars are as follows :

No. of coils = 4 ; mean radius of the coil = 30 mm ; diameter of the spring wire = 5 mm ; modulus of rigidity = 80000 MPa; angle of helix = 10° young's modulus = 2×10^5 N/mm^2.
