

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

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. Find the stress induced in the bar shown in Fig. 1 when subjected to a rise in temperature of 70°C. $E = 1 \times 10^5 \text{ N/mm}^2$ and $\alpha = 16.5 \times 10^{-6}/^\circ\text{C}$.

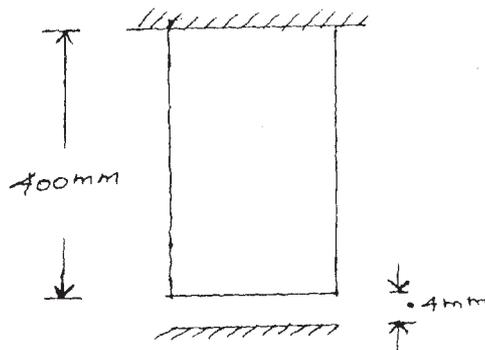


Fig. 1

- Is compound bar subjected to an axial load a determinate structure? How?
- State the conditions for the stability of a plane truss.
- Plane sections remain plane even after the application of the load— what is the result obtained from this assumption.
- Draw the shear force and bending moment diagram for a simply supported beam subjected to two concentrated loads (each equal to P) at a distance 'a' from each support.
- Draw the variation of bending stress and shear stress across a symmetric I section.
- Write the expression for strain energy due to Torsion.

8. Derive the expression for normal and tangential stresses on an inclined plane inclined at an angle θ to 'x' axis and is subjected to stress σ_x along 'x' axis only.
9. What are the general boundary conditions available for cantilever, simply supported and overhanging beams to evaluate the constants of integration in the double integration or Mecauly's method of finding deflection of beams.
10. Give the conjugate beam for (a) cantilever beam (b) over hanging beam with over hand on one side.

PART B — (5 × 16 = 80 marks)

11. Determine the magnitude and nature of forces in the member of the frame Fig. 2 by the method of joints.

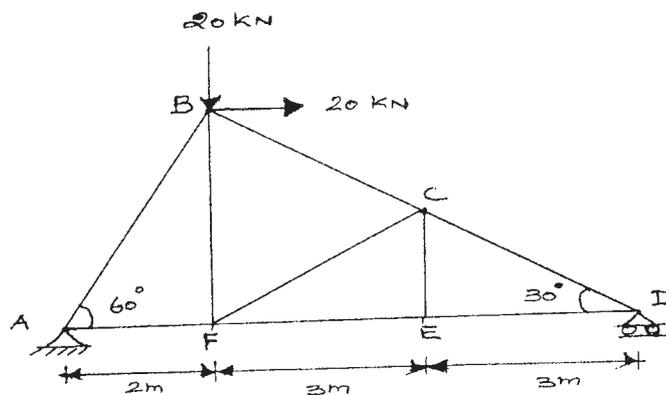


Fig. 2

12. (a) A steel bar 3.5 m long is acted upon by forces as shown in Fig. 3. Determine the value of P and the total elongation of the bar. Take $E = 2.05 \times 10^5 \text{ N/mm}^2$.

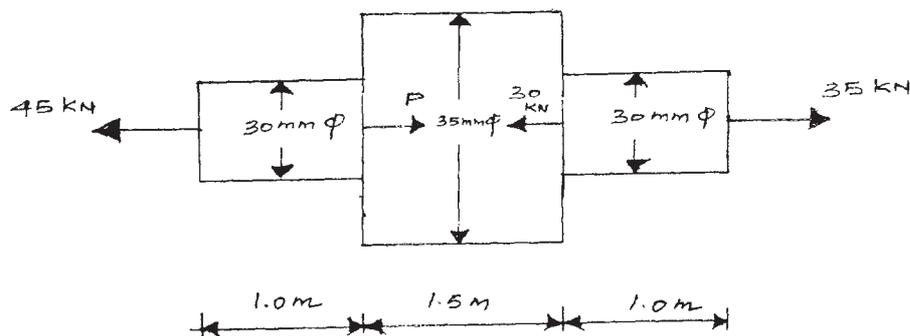


Fig. 3

Or

- (b) In a tensile test on a tube of external diameter 16 mm, bore 4 mm, an axial load of magnitude 3 kN produced a stretch of 0.003617 mm on a length of 40 mm while the outer diameter suffered a contraction of 0.0002894 mm. Calculate the Poisson's ratio, Young's modulus, Rigidity modulus and Bulk modulus.
13. (a) Draw the shear force and bending moment diagram for the beam shown in Fig. 4 giving the point of contraflexure, location and magnitude of maximum bending moment.

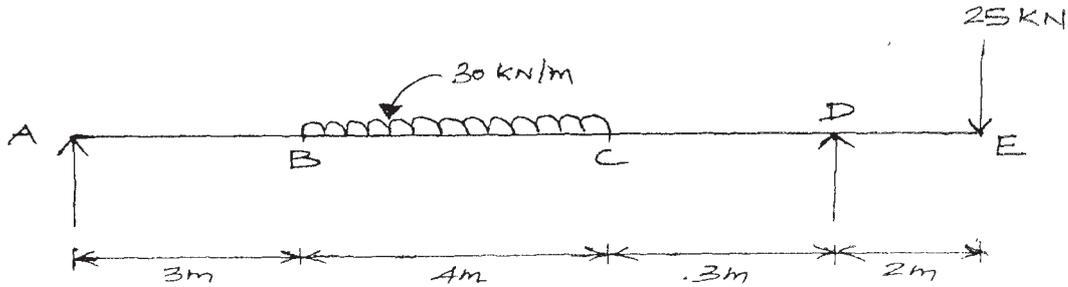


Fig. 4

Or

- (b) A simply supported beam of span 6 m is subjected to an uniformly distributed load of 20 kN/m over entire length. At a section 2 m from the left end and 30 mm above the neutral axis, determine the bending stress and shear stress. The cross section of the beam is as shown in Fig. 5.

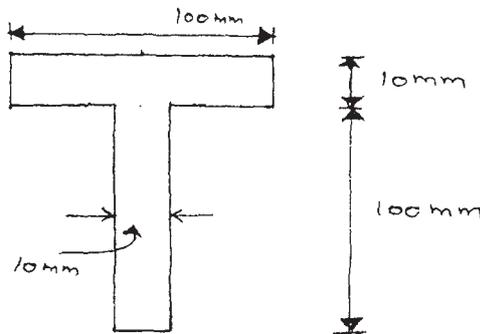


Fig. 5

14. (a) A hollow shaft has an external diameter of 100 mm and an internal diameter of 60 mm. It runs at 130 rpm. It is twisted through an angle of 1.8° over a length of 2.5 m. Determine the maximum shear stress in the shaft and the power transmitted. $N = 0.8 \times 10^5 \text{ N/mm}^2$.

Or

- (b) A close coiled helical spring is to have a stiffness of 1 N/m of compression under a maximum load of 45 N and a maximum shear stress of 125 N/mm^2 . The solid length of the spring (when the coils are touching) is to be 45 mm. Find (i) the diameter of the wire (ii) mean diameter of the spring and (iii) number of coils. Take $N = 0.4 \times 10^5 \text{ N/mm}^2$.
15. (a) At a point in a bracket the stresses on two mutually perpendicular planes are 650 N/mm^2 tensile and 400 N/mm^2 compressive. The shear stress across these plane sis 100 N/mm^2 . Find the principal planes, principal stresses and maximum shear stress.

Or

- (b) Calculate the maximum deflection for the beam shown in Fig. 6

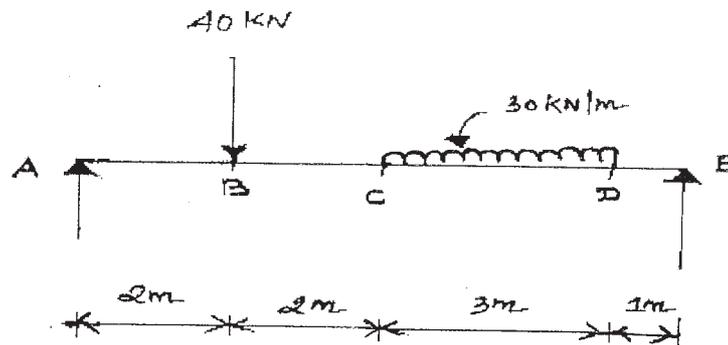


Fig. 6