WINTER - 2013

STRENGTH OF MATERIALS

1. (a) Draw stress-strain curve for mild steel under tension and explain the salient points. (6)

(b) A steel rod of cross-sectional area 2000 mm^2 and two brass rods each of cross-sectional area of 1200 mm^2 together support a load of 500 kN as shown in Fig. 1. Find the stresses in the rod. Take $E_{steel} = 2 \times 10^5$ N/mm^2 and $E_{brass} = 1 \times 10^5$ N/mm^2. (7)

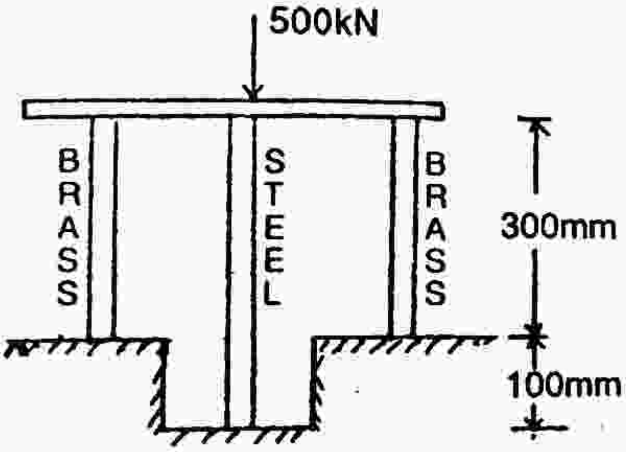

Fig. 1

(OR)

2. A composity bar made up of aluminium and steel is held between two supports as shown in Fig. 2. Calculate the stress in the two bars when temp. is raised to 60°C. The cross sectional area of steel bar is 200 mm^2 and that of aluminium bar is 250 mm^2. (13)

$E_{al} = 0.7 \times 10^5$ N/mm^2 ; $E_{steel} = 2 \times 10^5$ N/mm^2

$\alpha_{al} = 24 \times 10^{-6/o}C$; $\alpha_{st} = 12 \times 10^{-6/o}C$.

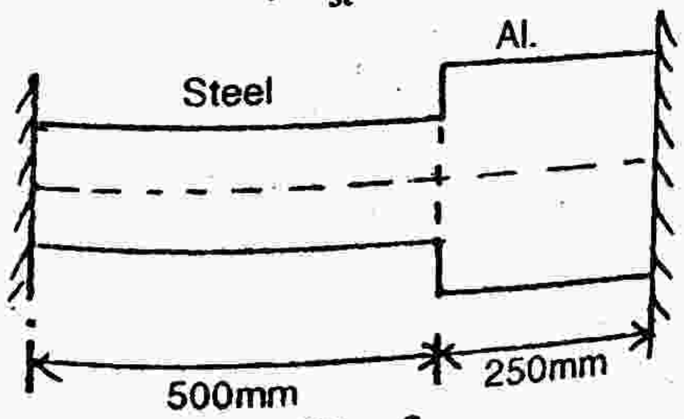

Fig. 2

3. Draw shear force and bending moment diagram for the beam shown in Fig. 3 and locate the point of contraflexure if any. (14)

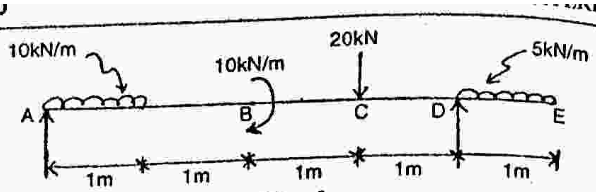

Fig. 3

(OR)

4. A beam ABCD carries a udl of intensity W kN/m over AC and 20 kN point load at D. It is supported at A and B. BD is overhang. AC = CB = 4 m, BD = 2 m. Calculate teh value of 'W' so that BM at C is 50 kN-m. Draw SFD and BMD for this beam for the calculated value of W. Locate the point of contra-flexure, if any. Also locate the Maximum BM values. (14)

5. (a) Derive the Bending formula and give the assumptions in theory of simple bending. (6)

(b) An I-Section beam 340 mm × 200 mm has a web thickness of 10 mm and and flange thickness of 20 mm. It carries a shearing force of 100 kN, sketch the shear stress distribution across the section. **(OR)** (7)

6. A simple supported beam carries a udl of 30 kN/m over a span of 1.0 m. The cross-section of beam is a 'T'-Section having dimensions as shown in Fig. 4. Calculate the maximum shear stress for the section of the beam. (13)

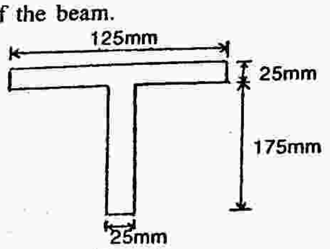

Fig. 4

7. (a) Derive the torsion equation $\frac{T}{J} = \frac{f_s}{R} = \frac{G\theta}{l}$. (6)

(b) A solid circular shaft is to transmit a power of 232 kW at 200 rpm. If the shear stree and angle of twist not to exceed 60 MPa adn 2° respectively, calculate the diameter of the shaft.

The maximum torque exceeds by 20% to that of mean torque. The length of the shaft is 3.5m. Assume $G = 82 \times 10^3$ N/mm^2.

(OR) (7)

8. A brass tube of external diameter 80 mm and internal diameter 50 mm is closely fitted to a steel rod of 50 mm diameter to from a composite shaft. If a torque of 6 kN-m is to be resisted by this shaft, find the maximum stresses develop in each material and angle of twist in 2 m length.

Take $G_b = 40 \times 10_3$ N/mm^2, $G_s = 80 \times 10^3$ N/mm^2. (13)

9. Calcualte the deflection under point loads for the beam shown in Fig. 5 by Macauley's method. (14)

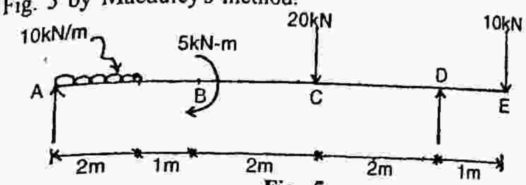

Fig. 5

(OR)

10. For the beam shown in Fig. 6, calculate slope at 'A' and 'D'.(14)

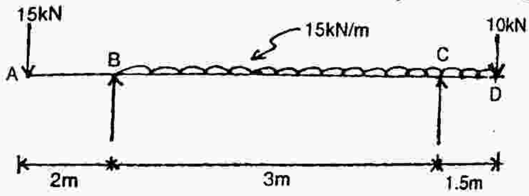

Fig. 6

11. Stress at a point is given below : (13)

σ_x = 100 MPa (T), σ_y = 75 MPa (C)

τ_{xy} = 50 MPa acting downward on right face

Calculate : (i) Principal plane's location. (ii) Principal stresses. (iii) Stress on plane making 30° clockwise with X-axis.

12. A point in a strained material is subjected to the stresses as shown in Fig. 7. (13)

(a) Locate the principal planes and evaluate the principal stresses.

(b) Find the principal strains assuming $\frac{1}{m} = 0.25$, $E = 2 \times 10^5$ N/mm^2.

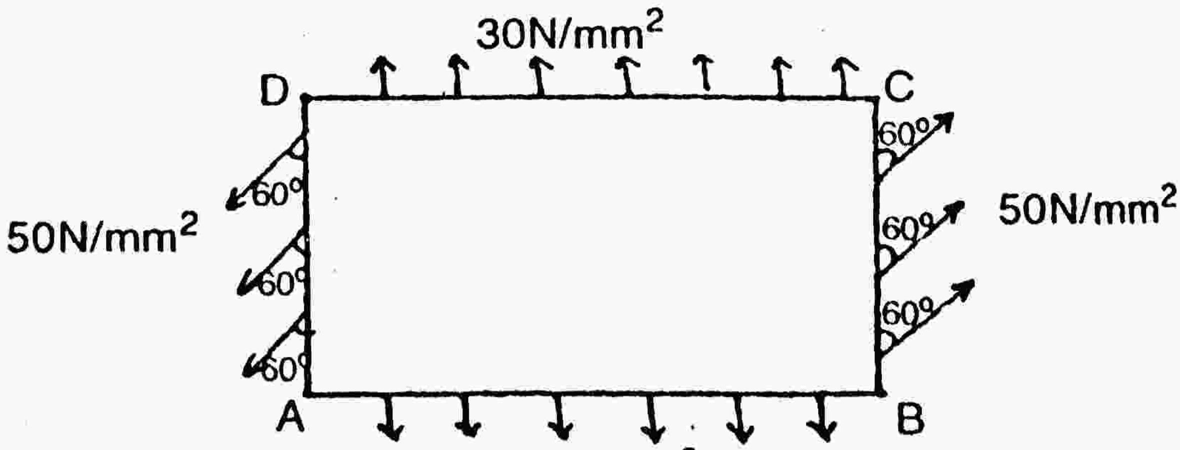

Fig. 7