SUMMER - 2014

STRENGTH OF MATERIALS

1. (a) Draw stress-strain diagram for MILD STEEL under tension and explain salient points. (7)

(b) A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in fig. 1. Calculate the force. P_3 necessary for equilibrium if P_1 = 120 kN, P_2 = 220 kN and P_4 = 160 kN. Determine also the net change in lenght of the member. Take $E = 2 \times 10^5$ N/mm^2. (7)

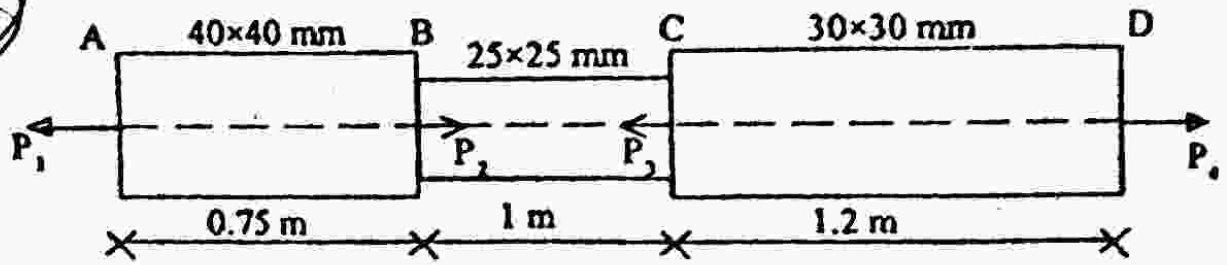

Fig. 1

(OR)

2. (a) A boiler is subjected to an internal pressure of 2N/mm^2. The thickness of the boiler is 15 mm and maximum permissible tensile stress is 120 N/mm^2. Find the maximum permissible diameter, when the efficiencies of the longitudinal and circumferential joints are 70% and 30% respectively. (6)

(b) A composite section is made up of copper rod 150 mm diameter enclosed in a steel tube 150 mm internal diameter and 10 mm thick. Length of the assembly is 500 mm and fastened at both ends. If the temperature of assembly is raised to 60°C, find stresses developed in each material. (8)

Take $E_{steel} = 2 \times 10^5$ N/mm^2. $E_{copper} = 1.05 \times 10^5$ N/mm^2

$\alpha_{steel} = 12 \times 10^{-6}$/°C $\alpha_{copper} = 17.5 \times 10^{-6}$/°C

3. Draw S.F. and B.M. diagram for the loaded beam shown in Fig. 2 and locate the point of contra flexure. (13)

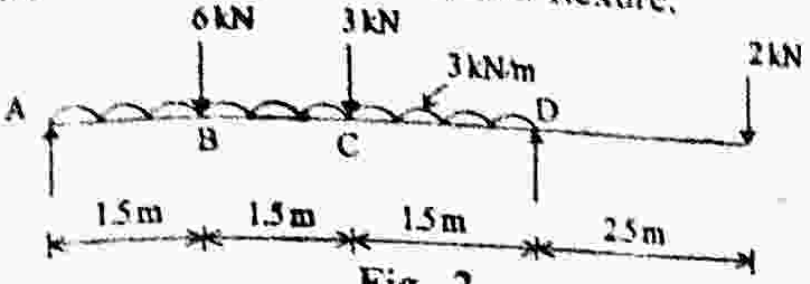

Fig. 2

(OR)

4. The overhang beam is loaded as shown in fig. 3. Draw S.F. and B.M. diagram for the beam : (13)

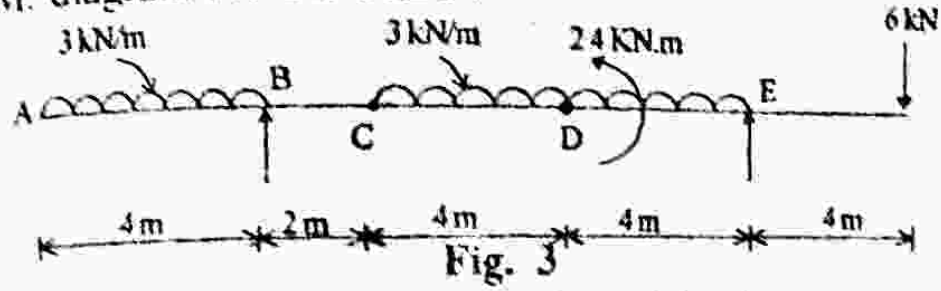

Fig. 3

5. A beam simple supported at ends and having cross section as shown in Fig. 4 is loaded with a uniformly distributed load over whole of its span. If the beam is 8 m long, find the uniformly distributed load, if maximum permissible tensile stress is limited to 70 N/mm^2 and in compression to 100 N/mm^2. (13)

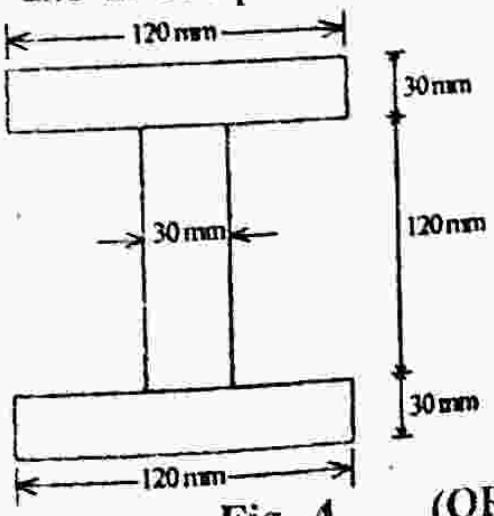

Fig. 4 (OR)

6. Derive bending stress formula for a beam subjected to transverse loading with suitable assumptions. (13)

7. A solid alloy shaft of 50 mm diameter is to be coupled in series with a hollow steel shaft of the same external diameter. If teh angle of twist per unit length of the steel shaft is to be 70 percent of that of alloy shaft, find the internal diameter of the steel shaft. Also find the speed at which the shaft is driven to transmit 20 kW if allowable shearing stress in alloy and steel are 56 MN/m^2 respectively. Take $C_{steel} = 2.25\ C_{alloy}$ (13)

(OR)

8. Derive torsional formula with suitable assumption for circular cross section. (13)

9. Determine the following of an over hanging beam ABC supported at A and B and loaded as shown in fig. 5. (13)
Take E = 200 × 10_6 kN/m_2, I = 13.5 × 10^{-6} m^4
(i) Deflection at the free end C;
(ii) Maximum deflection between A and B.

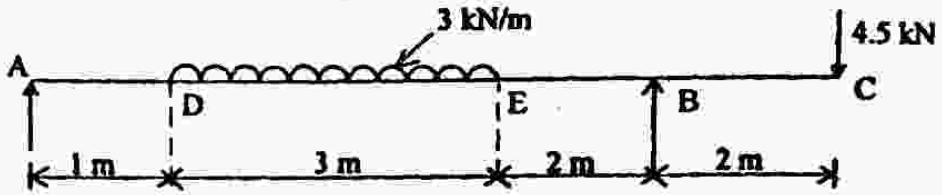

Fig. 5

10. The simp;y supported beam shown in fig. 6 carries two concetrated loads adn a uniformly distribution load. Calculate the deflection at D and C point. Take E = 200 GPA and I = 200 × 10^6 mm^4. (13)

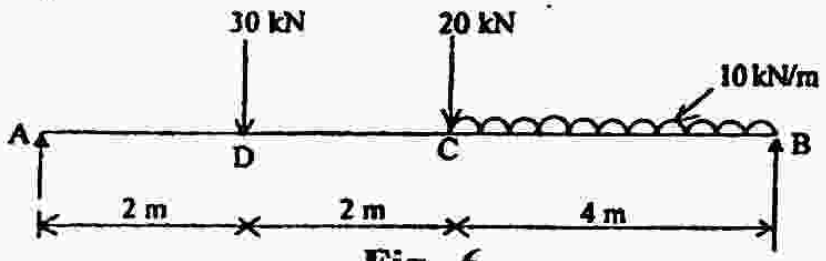

Fig. 6

11. Two planes AB and BC which are at right angles carry shear stresses of intensity 40 N/mm^2, while these planes also carry a tensile stress of 50 N/mm^2 and a compressive stress of 30 N/mm^2 respectively. (14)
Determine the principal planes and the principal stresses. Also determine the maximum shear stress and the planes of which it acts. (Refer Fig. 7)

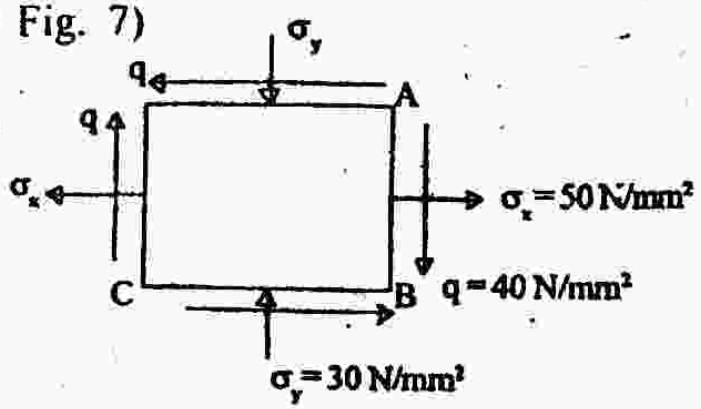

Fig. 7

(OR)

12. **Explain :** (a) Shear centre and shear flow. (14)
(b) Mohr's circle. (c) Unsymmetrical bending.

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