

**B.Tech. Civil (Construction Management) /  
B.Tech. Civil (Water Resources Engineering)**

**Term-End Examination**

**December, 2015**

**ET-502(A) : STRENGTH OF MATERIALS**

*Time : 3 hours*

*Maximum Marks : 70*

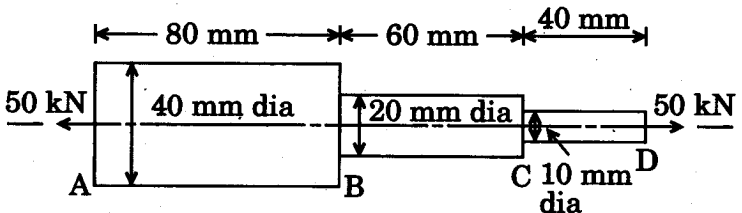
*Note : Answer any five questions. All questions carry equal marks. Assume any missing data suitably. Use of scientific calculator is permitted*

1. (a) Draw the stress-strain curve for a mild steel bar and label the salient points on the curve. 4

- (b) A bar (shown in Fig. 1) is subjected to a tensile force 50 kN. Determine the stresses in different sections of the bar and total longitudinal elongation.

Take  $E = 200 \text{ kN/mm}^2$ .

10



*Fig. 1*

2. (a) Define the terms Principal Stress and Principal Strain. 4

- (b) Find out the forces only in members AD, AC, DE and DC of the truss shown in Fig. 2. 10

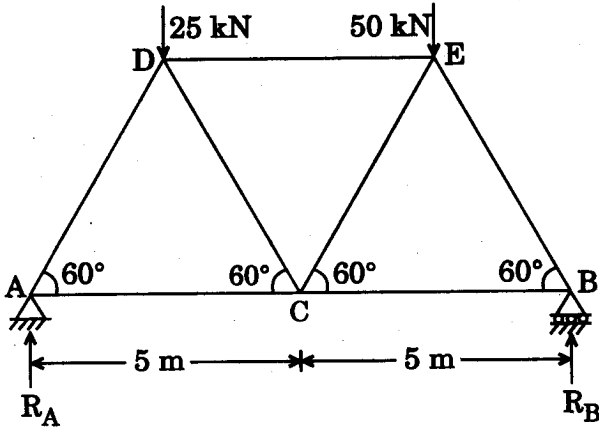


Fig. 2

3. (a) Find the centroid of the T-section shown in Fig. 3 and determine the moment of inertia of this section about the centroidal axes XX and YY. 10

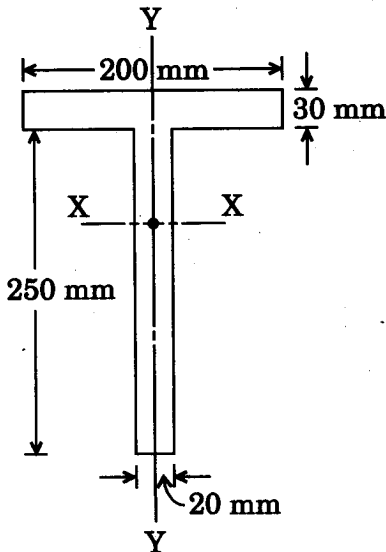


Fig. 3

- (b) Differentiate the term section modulus and flexural rigidity. 4
4. (a) A bar 12 mm in diameter is acted upon by an axial load of 20 kN. The change in diameter is measured as 0.003 mm. Determine the Poisson's ratio, modulus of elasticity and bulk modulus. Take modulus of rigidity as 80 GPa. 6
- (b) Draw the shear force and bending moment diagrams for the beam shown in Fig. 4. 8

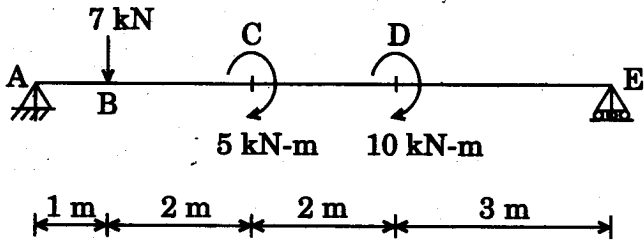


Fig. 4

5. Determine the moment of resistance of the composite beam (shown in Fig. 5) section. The beam is made of steel plates(s) placed firmly with timber section (T). Take  $E_s/E_t = 20$  and stress in wood should not exceed  $7.5 \text{ N/mm}^2$ . 14

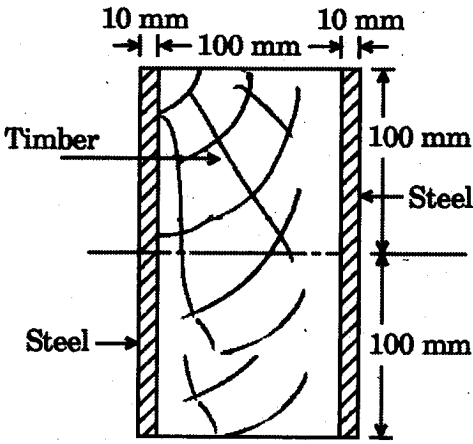


Fig. 5

6. (a) A hollow steel shaft of outside diameter 75 mm is transmitting a power of 150 kW at 1000 rpm. Find the thickness of the shaft, if the maximum shear stress in the shaft is limited to 40 MPa. Take  $G = 80 \text{ GPa}$ . 10
- (b) Describe the “springs in series” and “springs in parallel”. 4
7. (a) Describe the assumptions used for the analysis of Thin shells. 4
- (b) A circular rod of diameter varying from 100 mm at one end to 200 mm at the other end, is fixed between two supports. Determine the stress induced, if the temperature of the rod is raised by  $70^\circ\text{C}$ .
- Take  $E = 200 \text{ kN/mm}^2$   
 $\alpha = 1.2 \times 10^{-5}/^\circ\text{C}$   
 Length of rod = 1000 mm. 10
8. Prove the following : 2×7=14
- (a) Maximum shear stress in a rectangular section (subjected to shear force  $F$ ) is 1.5 times the average shear stress.
- (b) The stresses induced in a hanging rod due to impact load ‘ $W$ ’ will be two times of the stresses induced due to gradual load  $W$ .