

01710

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

**Term-End Examination
June, 2010**

ET-502(A) : STRENGTH OF MATERIALS

Time : 3 hours

Maximum Marks : 70

Note : Attempt any five questions. All questions carry equal marks.

1. Find forces in members AB, BC, BH, BG and CG of the truss shown in Fig. 1. 14

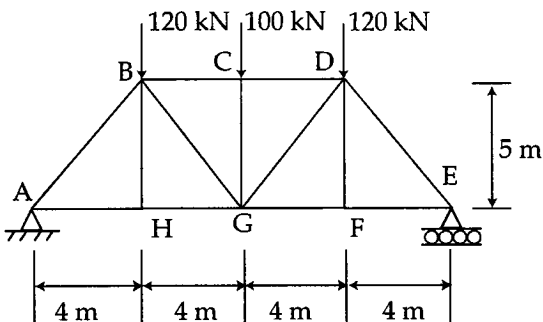


Fig. 1

2. (a) Define Poisson's ratio and modulus of elasticity. Draw stress - strain diagram for mild steel and mark yield points. 7
- (b) A bar specimen, of rectangular cross-section 25 mm × 100 mm, has a length of 2500 mm. The modulus of elasticity for the material of bar specimen is 172 GPa and Poisson's ratio is 0.35. Under an axial load of 430 kN, calculate the length and cross sectional dimensions. 7
3. In Fig. 2, the bar on the left is of copper and that on the right is of steel. Diameter of each bar is 60 mm. The gap between the bars is 0.25 mm. 14
- (a) Determine the total force on each bar if temperature is raised by 40°C.
- (b) Determine the deformation in each bar. The distance between the supports remains constant. $E_{\text{steel}} = 210 \text{ GPa}$, $E_{\text{copper}} = 113 \text{ GPa}$,

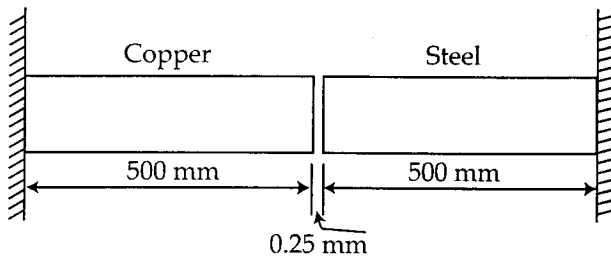


Fig. 2

$$\alpha_{\text{steel}} = 11.5 \times 10^{-6} \text{ per deg.C,}$$

$$\alpha_{\text{copper}} = 16.5 \times 10^{-6} \text{ per deg C.}$$

4. (a) The state of stress at a point in a structural member is as shown in Fig. 3. The tensile principal stress is known to be 84 N/mm^2 . 7

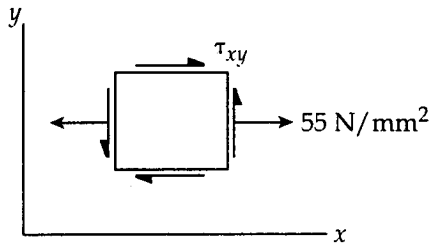


Fig. 3

Determine

- (i) the maximum shearing stress at the point and orientation of its plane.
- (ii) the shearing stress τ_{xy} .
- (b) The modulus of elasticity of a material is $2.1 \times 10^5 \text{ N/mm}^2$. Calculate modulus of rigidity and bulk modulus if Poisson's ratio is 0.28. 7
5. For the beam shown in Fig. 4, draw SFD and BMD. 14

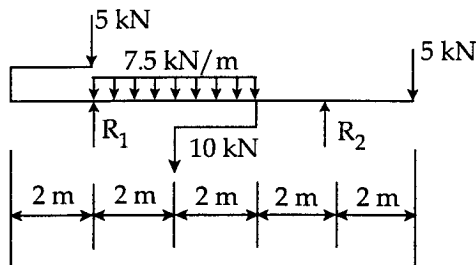


Fig. 4

6. (a) A cantilever 3 m long has a T-section, as shown in Fig. 5. It carries a load of 1000 N at the free end. Calculate the maximum tensile and compressive stresses in the beam. 7

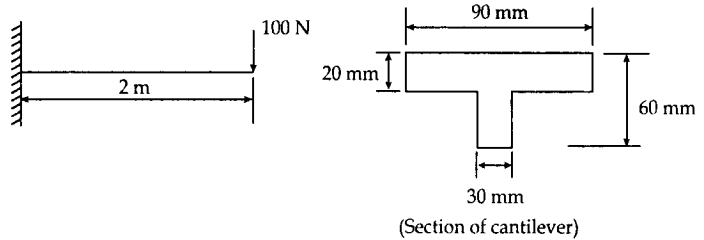


Fig. 5

- (b) What do you understand by strain energy ? 7
Describe briefly.
7. A 50 mm by 12.5 mm flat steel bar was placed in a testing machine and subjected to 60 kN load whose line of action passed 12.5 mm from the axis. An extensometer placed in line with the load recorded an extension of 0.0065 mm over a gauge length of 10 mm. Calculate the max and min. stresses induced in the bar and modulus of elasticity. (see Fig. 6) 14

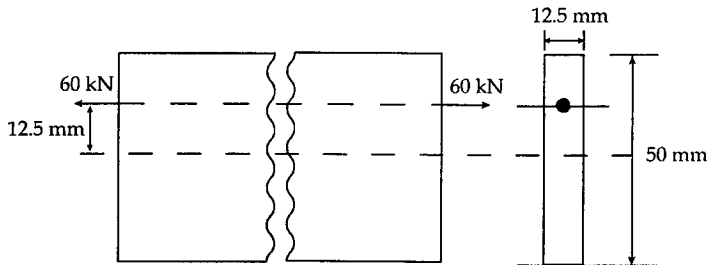


Fig. 6

8. (a) A hollow steel shaft of external dia. twice the internal dia. has the same weight as a solid shaft and both are made of same material. What torque will be carried by the hollow shaft when max. shearing stress is τ which is induced in solid shaft when it carries a torque T. 7
- (b) State and explain Castigliano's theorem. 7
-