

II B.Tech I Semester Supplementary Examinations, May 2005
MECHANICS OF SOLIDS
 (Common to Mechanical Engineering, Mechatronics, Metallurgy & Material
 Technology, Production Engineering and Aeronautical Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Derive relation between three elastic moduli
 (b) Draw stress - strain diagram for mild steel. Indicate salient points and define them.
2. A steel rod 28 mm diameter is fixed concentrically in a brass tube of 42 mm outer diameter and 30 mm inner diameter. Both the rod and tube are 450 mm long. The compound rod is held between two stops which are exactly 450 mm apart and the temperature of the bar is raised by 70°C.
 (a) Find the stresses in the rod and tube if the distance between the stops is increased by 0.30 mm.
 (b) Find the increase in the distance between the stops if the force exerted between them is 90 kN

Take $E_s = 200 \text{ kN/mm}^2$; $\alpha_s = 11.2 \times 10^{-6} \text{ per}^\circ\text{C}$
 $E_b = 90 \text{ kN/mm}^2$; $\alpha_b = 2.1 \times 10^{-5} \text{ per}^\circ\text{C}$

3. A horizontal beam of 10m long is carrying a uniformly distributed load of 1 kN/m over the entire length. The beam is simply supported on two supports 6m apart. Find the position of the supports, so that the BM on the beam is as small as possible. Also draw the SF and BM diagrams.
4. A rolled steel joint of I section top and bottom flanges 160 mm × 25 mm are web of size 300 mm × 20 mm. It is used as a simply supported beam over a span of 5 m to carry on udl of 75 kN/m over its entire span. Draw the bending and shearing stresses across a section at $(\frac{1}{4})^{th}$ of span.
5. (a) What is moment area method? Explain the two Mohr's theorems, as applicable to the slope and deflection of a beam.
 (b) A cantilever of uniform cross-section of length l carries two point loads, W at the free end and 2W at a distance a from the free end. Find the maximum deflection due to this loading.
6. (a) Explain horizontal and hoop stresses as applied to thin cylinders.
 (b) What thickness of metal would be required for cast-iron water pipe 90 cm in diameter under a head of 100m? Assume the permissible tensile stress for cast iron as 20 MN/ m².

7. At a point in material under stress, the intensity of resultant stress on a certain plane is 60 N/mm^2 (tensile) inclined 30° to normal of that plane. The stress on a plane at right angles to this has a normal tensile component of intensity 40 N/mm^2 . Find fully
- (a) The resultant stress on the second plane
 - (b) The principal planes and stresses
 - (c) The plane of maximum shear and its intensity.
8. At a point in a loaded specimen the principal stresses acting on two mutually perpendicular planes are 60 N/mm^2 and 40 N/mm^2 , both being compressive. Determine the resultant stress acting on a plane inclined at 60° measured clockwise to the plane on which the larger of the normal stress is acting.
