Subject (Name & Code): Mechanics of Solids (CIE 1051)

Date of Examination:

Assignment test - IV

. . . . . .

Total Marks:

Q. No	Questions	Marks	CO
1	A circular mild steel rod is enclosed in a copper tube as shown in **Fig: 1**. The copper tube is 50mm thick. The compound bar is then acted upon by an axial compressive load of P = 450 kN. Find the stresses in steel and copper. Also calculate the compressive strain. Given, Est = 210 kN/mm^2; Ecu = 110 kN/mm^2.	5	5
2	Three bars of same cross sectional area of 200 mm^2 support a rigid bar carry a weight as shown in **Fig: 2**. If stress in the middle bar is 10 N/mm^2, find the stresses in the remaining bars and elongation in each bar. The modulus of elasticity is 2.1×10^5 for all the bars.	5	5
3	A composite bar is rigidly fixed at A and B and is acted upon by a 40 kN load as indicated in the **Fig: 3**. Determine the reaction at the supports when the temperature is raised by 20 ºC. Take E_{Al} = 70 GPa, E_{Cu} = 100 GPa; α_{Al} = 24 x 10^{-6}/ ºC and. α_{Cu} = 18 x 10^{-6}/ ºC.	5	5
4	A compound bar consists of a brass portion AB and steel portion BC fixed between two rigid supports as shown in **Fig: 4**. If the temperature is increased by 140° C, find the force exerted on the supports and change in length of segment AB. Consider E_{br} = 85 GPa; α_{br} = 20×10^{-6} /ºC and E_{st} = 210 GPa, α_{st} = 11×10^{-6} /ºC.	5	5
5	A horizontal rigid bar weighing 80 kN is hung by two vertical rods as shown in **Fig: 5**. Temperature rise is 40º C. Determine the stress in each rod and by how much the horizontal bar descends. Given, α_s = 11.7 x 10^{-6}·/°C for steel and α_{br} =18.9 x 10^{-6}·/°C for bronze.	5	5
6	A copper bar is placed between two aluminium bars. The copper bar and aluminium bars have c/s 80 mm × 20 mm and 60 mm × 10 mm respectively, and are connected rigidly on each side. If the temperature is raised by 58°C, find stress in each metal and change in length. The length of bar at normal temperature is 1.2m. Take E_{Al} = 70 GPa, E_{Cu} = 100 GPa; α_{Al} = 24 x 10^{-6}/ ºC and. α_{Cu} = 18 x 10^{-6}/ ºC.	5	5
7	A reinforced concrete column 200 mm in diameter is designed to carry an axial compressive load of 300 kN. Determine the required area of the reinforcing steel if the allowable stresses are 6 MPa and 120 MPa for the concrete and steel, respectively. Use Eco = 14 GPa and Est = 200 GPa.	5	5

8	A rigid block of weight W is supported by three symmetrically spaced rods as shown in **Fig. 8**, each copper rod has an area of 900 mm^2; E = 120 GPa; and the allowable stress is 70 MPa. The steel rod has an area of 1200 mm^2, E = 200 GPa and the allowable stress is 140 MPa. Determine the largest weight W which can be supported.	5	5
9	A welded steel cylindrical drum made of a 10 mm plate has an internal diameter of 1.20 m. Compute (i) circumferential stress, (ii) longitudinal stress, (iii) the change in length, (iv) change in diameter and (v) change in volume of the thin cylinder that would be caused by an internal pressure of 1.5 MPa. Assume that Poisson's ratio is 0.30 and E = 200 GPa.	5	4
10	A cylindrical boiler is 1000mm in diameter and 1.1m length. It is required to withstand a pressure of 120m of water. If the permissible tensile stress is 25N/mm^2, permissible shear stress is 10N/mm^2 and permissible change in diameter is 0.22mm, find the minimum thickness of the metal required. Take E = 90GPa and μ = 0.3.	5	4

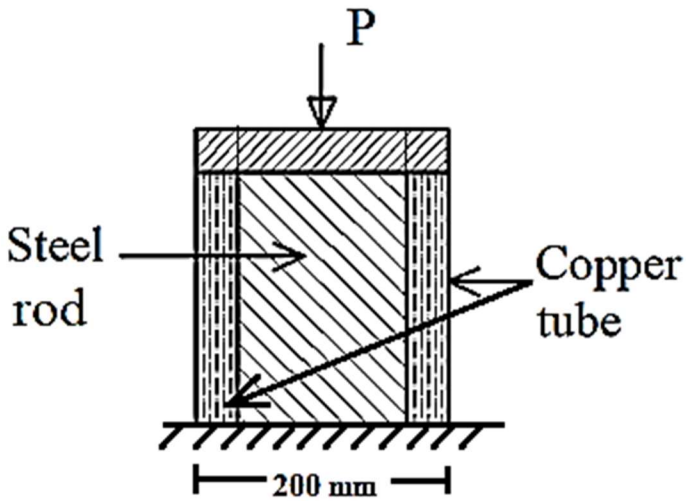

Fig: 1

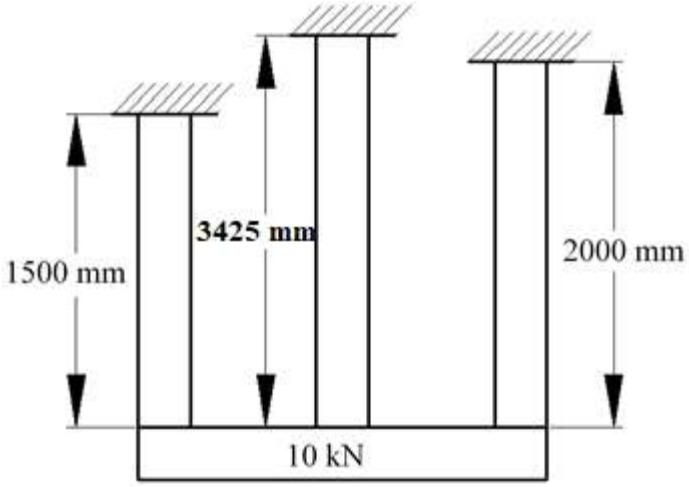

Fig: 2

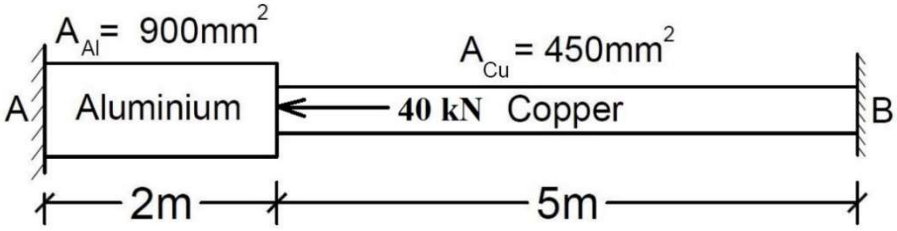

Fig: 3

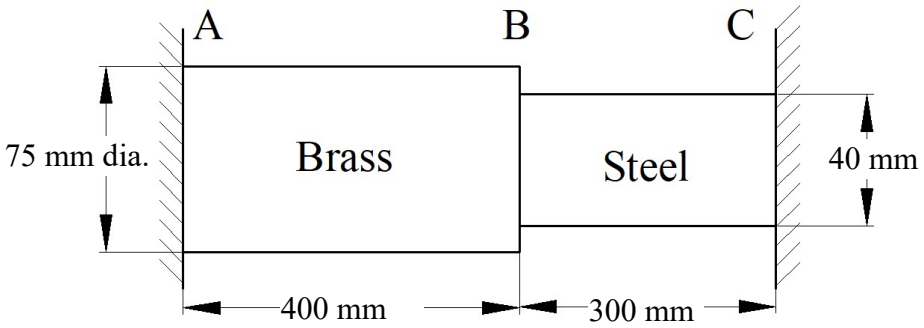

Fig: 4

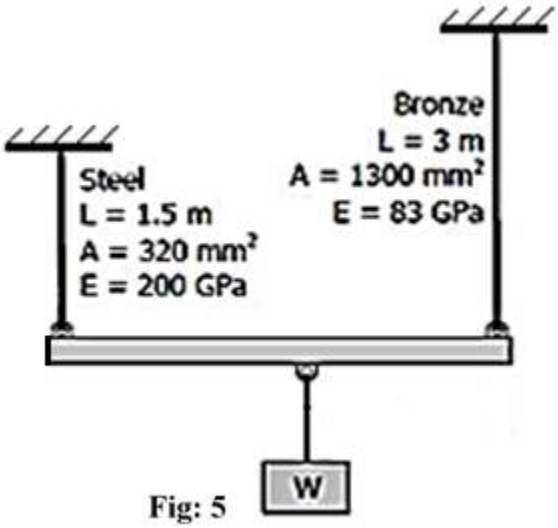

Fig: 5

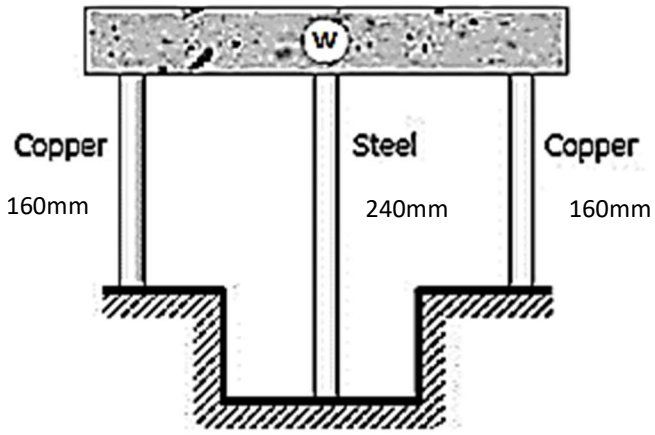

Fig: 8