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# ASSIGNMENT - AXIALLY LOADED MEMBERS

1)

A composite system of two metal bars, as shown below, is made of two dissimilar materials having areas of cross section $A_1$ and $A_2$, Young's moduli $E_1$ and $E_2$ and coefficients of thermal expansion $\alpha_1$ and $\alpha_2$. If the temperature of the system is raised by $\Delta T$, then the resultant axial force required to be applied to the rigid end plates to maintain the same length L is
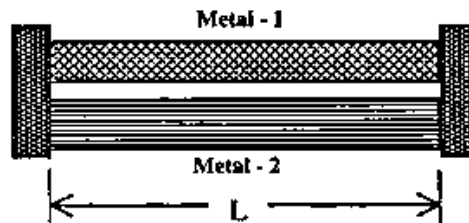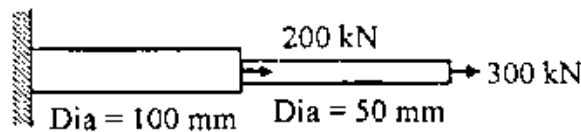


(A)  $(E_1 \alpha_1 A_1 + E_2 \alpha_2 A_2 ) \Delta T$
(B)  $(1/E_1 \alpha_1 A_1 + 1/E_2 \alpha_2 A_2 )^{-1} \Delta T$
(C)  $(E_1 + E_2) (\alpha_1 + \alpha_2) (A_1 + A_2) \Delta T$
(D)  $( E_1 \alpha_1 A_1 / E_2 \alpha_2 A_2 ) \Delta T$

*[GATE XE 2009]*

2)

A stepped circular shaft, fixed at one end, is subjected to two axial forces as shown below. The maximum tensile stress in the shaft is



(A) 120 MPa                          (B) 210 MPa

(C) 153 MPa                          (D) 390 MPa

*[GATE XE 2009]*

3)

A 9 kN tensile load will be applied to a 50 m length steel wire with $E = 200$ GPa. The normal stress in the wire must not exceed 150 MPa and the increase in the length of the wire should be at most 25 mm. Which among these could be the smallest diameter of the wire so that the wire does not fail?

(A) 5.75 mm          (B) 7.75 mm          (C) 8.75 mm          (D) 10.7 mm

*[GATE XE 2008]*

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4)

Three masses $M$, $2M$ and $3M$ are attached by circular cross section wires and are rotated around a vertical axis on a frictionless plane at 4 Hz as shown in the figure. Consider the masses to be concentrated as points. For equal stresses in wires in all the three segments, the cross sectional areas of the wires in the three segments 1, 2 and 3 should be in the ratio
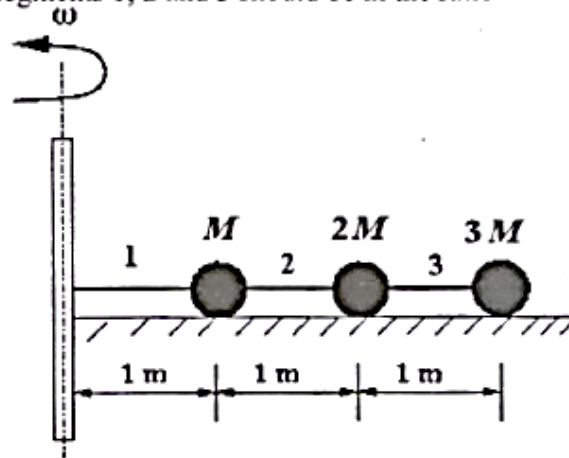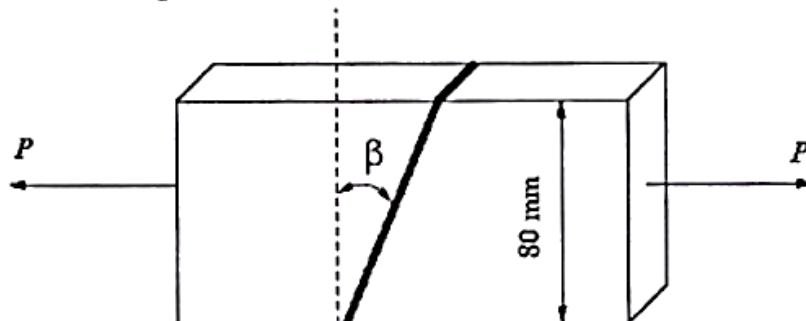


(A) 1:2:3        (B) 3:2:1        (C) 9:4:1        (D) 14:13:9

*[GATE XE 2008]*

5)

Two steel plates of uniform cross section 10 mm x 80 mm are welded together and subjected to an axial load of $P=100$ kN as shown in the figure. Allowable normal stress (tension and compression) and allowable shear stress for the material of the weld are 100 MPa and 50 MPa respectively and $\beta=25^0$. Which of the following is true?



(A) The joint will fail due to normal tensile stress.
(B) The joint will fail due to normal compressive stress.
(C) The joint will fail due to shear stress.
(D) The joint will not fail.

*[GATE XE 2008]*