Sohag university
Faculty of Engineering
First year
Civil Eng. Department
Strength & properties of Materials 1
sheet (1)
Stresses and strains of Metallic Materials

1. For the steel bar shown in Fig. (1), determine the stresses and total deformation due to the applied load. Take E= 2×10^6 kg/cm^2.

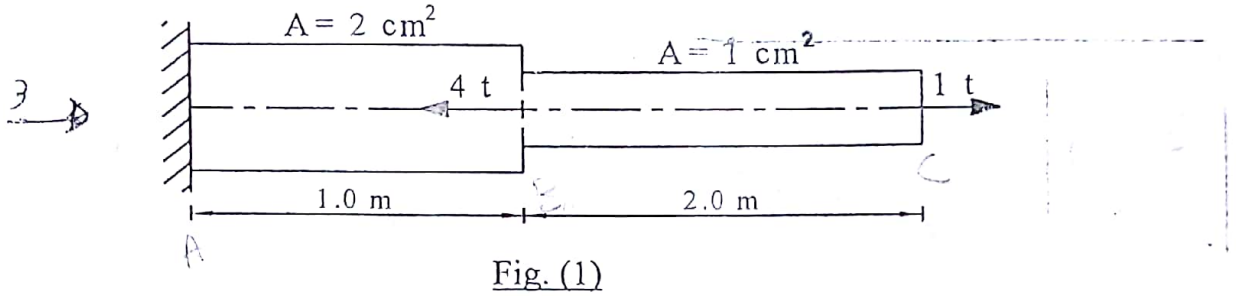

Fig. (1)

2. A steel bar of cross-section 4cm^2 subjected to the forces shown in Fig. (2). Determine the stresses in section 1-1 and 2-2. Find also the total elongation of the bar. Take E= 2×10^6 kg/cm^2.

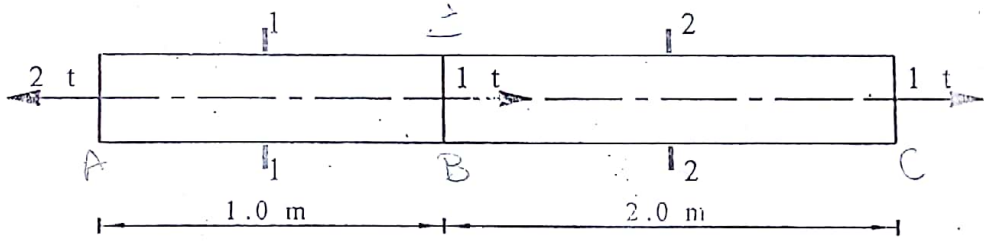

Fig. (2)

3. Determine the stresses in cross section 1-1, 2-2, 3-3 and the total change in the length for the rode shown in fig. (3). The cross-sectional area of the rode = 4 cm^2, and the modulus of elasticity (E) = 2×10^6 kg/cm^2.

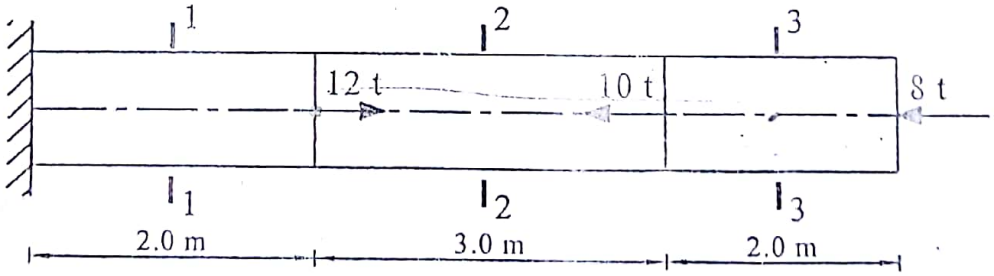

Fig. (3)

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A member ABCD is subjected to point load P_1, P_2, P_3 and P_4 as shown in Fig. (4). Calculate the force P_2 necessary for equilibrium if $P_1 = 4.5$t, $P_3 = 4.5$ t and $P_4 = 13$ t. determine the total elongation of the member if the modulus of elasticity (E) = 2×10^6 kg/cm^2.

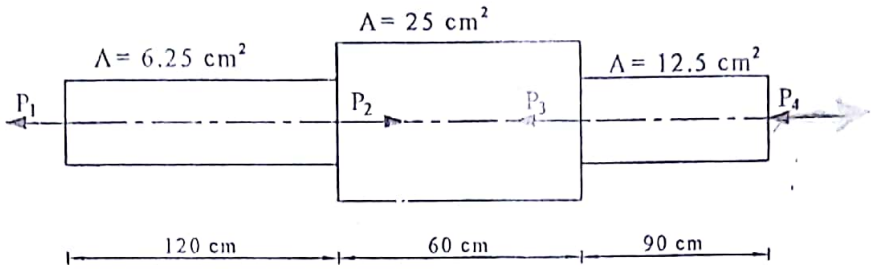

Fig. (4)

5. Find the stresses and deformation in the steel rode shown in Fig. (5) due to the applied loads. Given data E= 2×10^6 kg/cm^2, $d_1 = 20$mm and $d_2 = 30$ mm.

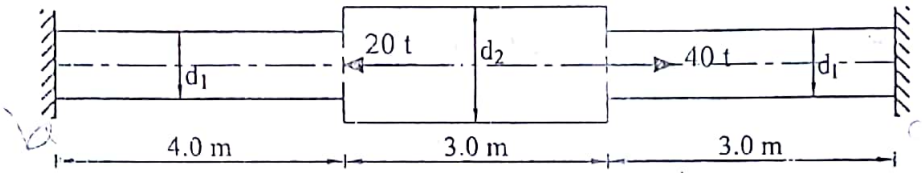

Fig. (5)

6. For the three steel rods support the structure shown in Fig. (6), calculate the stress in each rod, and the complete displacement of the point K. the cross-sectional area of rode 1 = 19.2 cm^2, rod 2 = 26.6 cm^2 and rod 3 = 26.8 cm^2.

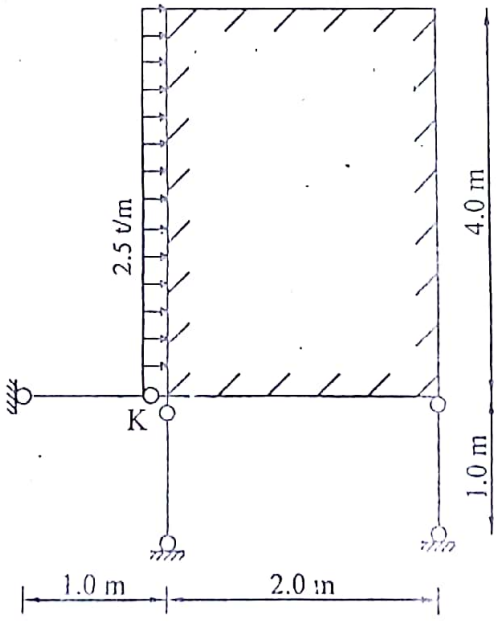

Fig. (6)

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A load P is carried by three steel bars, all of the same material and cross-sectional area of 4 cm^2 as shown in Fig. (7). If there are no initial stresses in the bars, before the load P of 8 ton is applied, find the unit stress in each bar and the deflection of the point O after the load is applied.

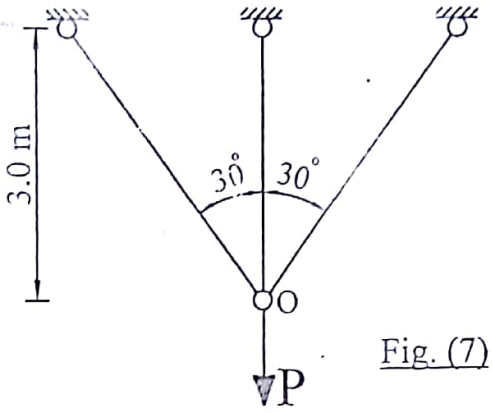

Fig. (7)

8. A load P = 10 t hangs from two rods AC and BC (Fig. 7). If the rod AC is made from aluminum (E = 0.7 × 10^6 kg/cm^2) and BC is made from steel (E = 2 × 10^6 kg/cm^2) and the allowable stress for steel and aluminum equal (σ) = 1500 kg/cm^2, find the cross-section of each rod and the horizontal and vertical displacement of the point C.

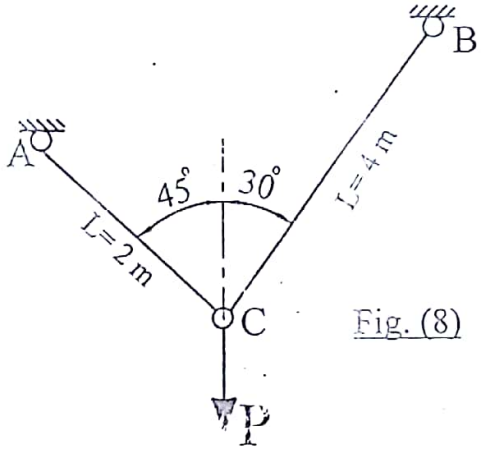

Fig. (8)

9. In Fig. (8), if the rode AO is steel and BO is from wood. Allowable stress for steel (σ_s) = 1600 kg/cm^2, and for wood (σ_w) = 40 kg/cm^2. Determine the diameter of the steel rod (d) if the cross-section is circular and the side (a) of square cross-section of the wooden rod. Find also the total displacement of the point O. Take E_s = 2 × 10^6 kg/cm^2, E_w = 1 × 10^5 kg/cm^2.

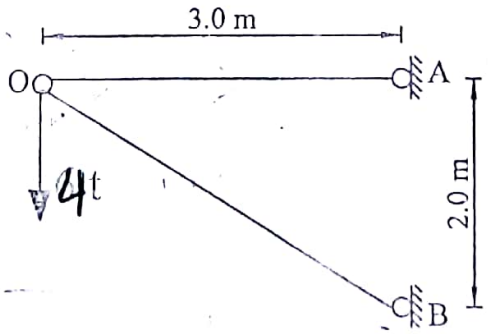

Fig. (9)

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The group of bars shown in Fig. (10) is subjected to concentrated load P= 20 t. Find the position of the load P such that the beam ABC remains horizontal after deformation.

$E_1 = 2 \times 10^6$ kg/cm^2, $L_1 = 150$ cm, $D_1 = 2.5$ cm

$E_2 = 1.8 \times 10^6$ kg/cm^2, $L_2 = 90$cm, $D_2 = 2.8$ cm

$E_3 = 2 \times 10^6$ kg/cm^2, $L_3 = 110$ cm, $D_3 = 2.5$ cm

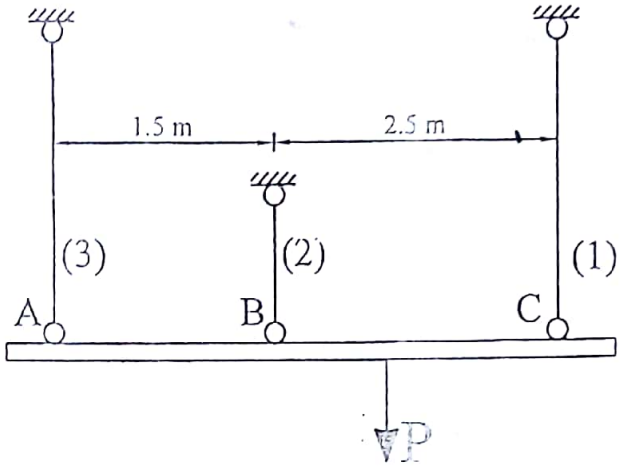

Fig. (10)

11. For the structures shown in Fig. (11), bar A is made of aluminum alloy and bar B is made of high tensile steel. Each bar has a cross section area of 9 cm^2. Determine the maximum permissible value for the load P applied as shown in Figure, if the allowable axial stresses are 3000 kg/cm^2 for steel and 1200 kg/cm^2 for aluminum alloy.

$E_A = 0.7 \times 10^6$ kg/cm^2, $E_B = 2 \times 10^6$ kg/cm^2

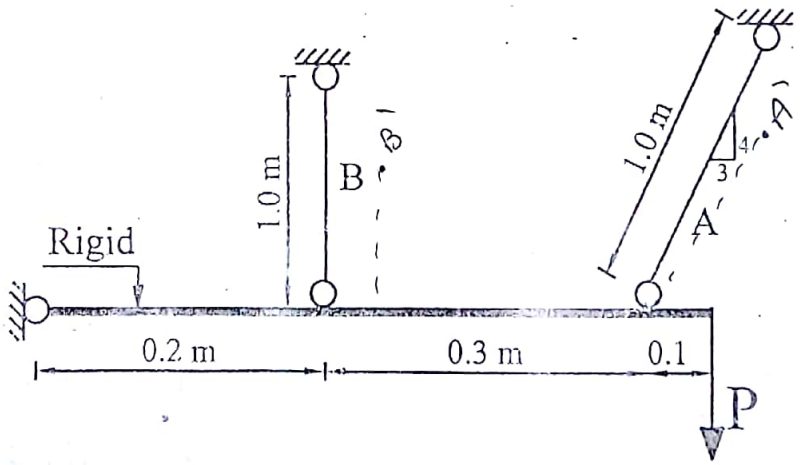

Fig. (11)

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