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Program **B.Tech civil**

Subject **Mechanics of Material**

Assignment **No 1**

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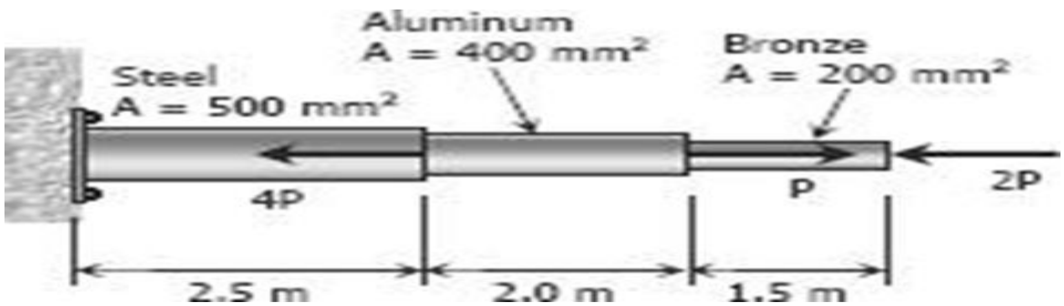
i. An aluminum rod is rigidly attached between a steel rod and a bronze rod as shown in Fig. below. Axial loads are applied at the positions indicated. Find the maximum value of P that will not exceed a stress in steel of 200 MPa, in aluminum of 140 MPa, or in bronze of 130 MPa.



Sol

$\sum f = 0$ 4p + 2p – p = 0

$\sum fx = 0$ 6p – p = 5p

At(a)

P1 = 5P

At(b)

$\sum fx = 0$ + 2p – p = 0

$\sum fx =$ + p2o2 – p

P2 = -p

At(c)

$\sum fx = 0$ P3 – 1 = 0

P3 = 2P

P1 = 5P   P2 = -P   P3 = 2P

$\delta \;=\; \frac{\sum}{iL1} \quad \frac{P1L1}{AiEi}$

$\delta = \frac{P1L1}{A1E1} + \frac{P2L2}{A2E2} + \frac{P3L3}{A3E3}$

$\delta = \frac{5(2.5)}{500X2000X} 10^6 + \frac{(-1)(2.0)}{400X140} 10^6 + \frac{2(1.5)}{100X130X} 10^6$

$\delta = \frac{12.5}{1X10} 10^{12} - \frac{2}{5.6X} 10^6 + \frac{3}{2.6X} 10^6$

$\delta = 1.25\ X\ 10^{13}\ - 0.357\ X\ \ 10^{-6} + 1.154\ X\ 10^6$

$\delta = 2.047\ X\ 10^{13-6-6}$

$\delta = 2.047\ X\ 10^{13+6-6}$

$\delta = 2.047\ X\ 10^1$ = 20.47 N/m^2

δ = 20.47 N/m^{-2}

Q no 2

Given Data   A = 2.5in   E = 20x10^6 PSI   P = 3500 Ib

I = ?

Sol = σ = P/A =1400

P1 = 0   P2 = -3

P3 = -1   P4 = -6

$\sigma =$ ∑P1L/AE

$\sigma = \frac{P1L}{AE} + \frac{P2L}{AE} + \frac{P3L}{AE} + \frac{P4L}{AE}$

$\sigma = \frac{L}{AE}$ (P1+P2+P3+P4)

$\sigma = \frac{L}{AE}$ (0- 3 – 1- 6)

$AE\ X\ \sigma = \frac{L}{AE}$ (-10) X AE

L = $\frac{AEO}{-1} = \frac{2.5\ X\ 20X1400X10^{-6}}{-10}$

L = -70000 X 10^{-6}

Length will never negative

L = -70000 X 10^{6} in