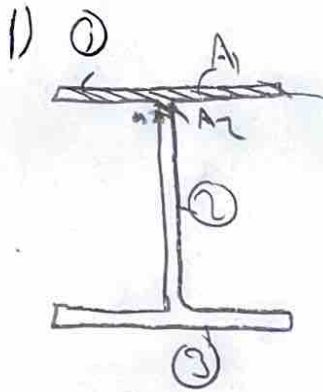


The Answers of ME 108 Quiz 2



$$I = \frac{1}{12} b h^3 + A d^2$$

$$I_1 = \frac{1}{12} 250 \times 15^3 + 250 \times 15 \times (117,5)^2 = 51843750$$

$$I_2 = \frac{1}{12} 10 \times 220^3 = 8873333 \text{ mm}^4$$

$$I_3 = I_1 = 51843750 \text{ mm}^4$$

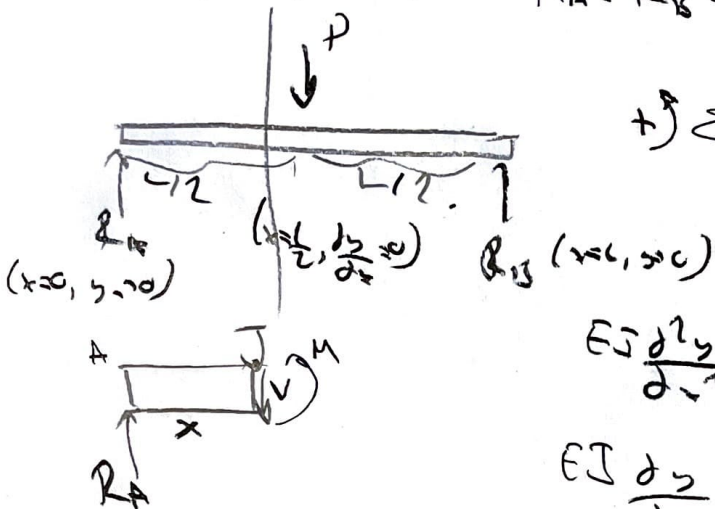
$$I = I_1 + I_2 + I_3 = 112,56 \times 10^6 \text{ mm}^4$$

$$Q_a = A_1 y_1 + A_2 y_2$$

$$= (3750)(117,5) + (10 \times 10) \times 105 = 451125 \text{ mm}^3$$

$$\tau_a = \frac{V Q_a}{I \cdot t} = \frac{(200 \times 10^3)(451125 \times 10^{-9})}{(112,56 \times 10^6)(0,01)} = \boxed{80,1 \text{ MPa}}$$

2) By symmetry $R_A = R_B = \frac{1}{2} P$



$$+\circlearrowleft \sum M_j = 0 \quad M - R_A x = 0$$

$$M = R_A x = \frac{1}{2} P x$$

$$EI \frac{d^2 y}{dx^2} = \frac{1}{2} P x$$

$$EI \frac{dy}{dx} = \frac{1}{4} P x^2 + C_1$$

$$EI y = \frac{1}{12} P x^3 + C_1 x + C_2$$

$$(x=0, y=0) \Rightarrow 0 = 0 + 0 + C_2 \Rightarrow C_2 = 0$$

$$(x=\frac{L}{2}, \frac{dy}{dx}=0) \Rightarrow 0 = \frac{1}{4} P (\frac{L}{2})^2 + C_1 \Rightarrow C_1 = -\frac{1}{16} P L^2$$

Elastic curve $\Rightarrow y = \frac{P L}{48 E I} (4x^3 - 3L^2 x)$

$$\frac{dy}{dx} = \frac{P L}{16 E I} (4x^2 - L^2)$$

Slope at A $x=0 \Rightarrow \frac{dy}{dx} = \frac{-P L^2}{16 E I}$

$$E = 200 \times 10^9 \text{ Pa}$$

$$EI = 1.76 \times 10^6 \text{ N.m}^2$$

Deflection at C $x=\frac{L}{2} \Rightarrow y_c = -\frac{P L^3}{48 E I}$

a) $\theta_A = \frac{(50 \times 10^3)(1.15)^2}{16(1.76 \times 10^6)} \Rightarrow \theta_A = 2.77 \times 10^{-3} \text{ rad. } \swarrow$

b) $y_c = \frac{(50 \times 10^3)(1.15)^3}{(48)(1.76 \times 10^6)} = 1.156 \times 10^{-3} \text{ m} \quad y_c = 1.156 \text{ mm } \downarrow$