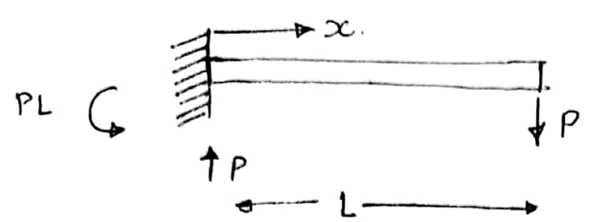
ASSIGNMENT 11.

1]



$$EI\frac{d^2y}{dx^2} = -PL + Px$$

$$EI\frac{dy}{dx} = -PLx + \frac{Px^2}{2} + C_1$$

$$EIy = -\frac{PLx^2}{2} + \frac{Px^3}{6} + C_1x + C_2$$

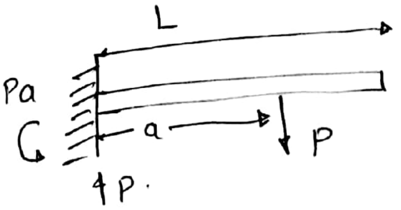
$y(0) = 0$; $y'(0) = 0$

$\therefore C_2 = 0$; $C_1 = 0$

$$y = \frac{P}{EI}\left[x^3 - 3Lx^2\right]$$

(2) $$y_{L/2} = \frac{P}{EI}\left[\frac{L^3}{8} - \frac{3L^3}{4}\right]$$

$$= \frac{-5PL^3}{48EI}.$$



(3) $$EI\frac{d^2y}{dx^2} = px - pa - p(x-a)$$

$$EI\frac{dy}{dx} = \frac{px^2}{2} - pax - \frac{p(x-a)^2}{2} + C_1$$

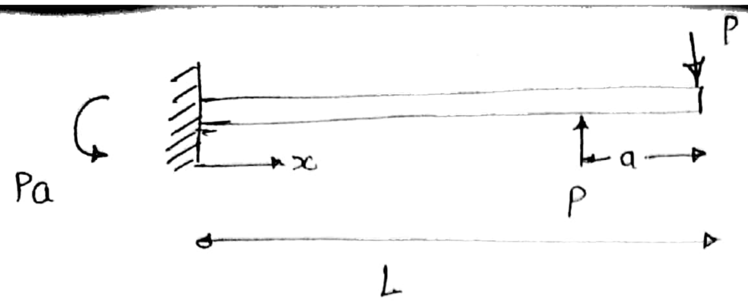
$y'(0) = 0$; $\therefore C_1 = 0$

$$EIy = \frac{px^3}{6} - \frac{pax^2}{2} - \frac{p(x-a)^3}{6} + C_1x + C_2 ;$$

$y(0) = 0$; $\therefore C_2 = 0$

$$y = \frac{P}{6EI}\left[x^3 - 3ax^2 - (x-a)^3\right]$$

④



$$EI\frac{d^2y}{dx^2} = -Pa + P(x-L+a)$$

$$EI\frac{dy}{dx} = -Pax + \frac{1}{2}P(x-L+a)^2 + C_1$$

$$y'(0) = 0 \quad ; \quad \therefore C_1 = 0$$

$$EIy = -\frac{Pax^2}{2} + \frac{1}{6}P(x-L+a)^3 + C_1x + C_2.$$

$$y(0) = 0 \quad ; \quad \therefore C_2 = 0$$

$$y = \frac{P}{6EI}\left[-3ax^2 + (x-L+a)^3\right]$$

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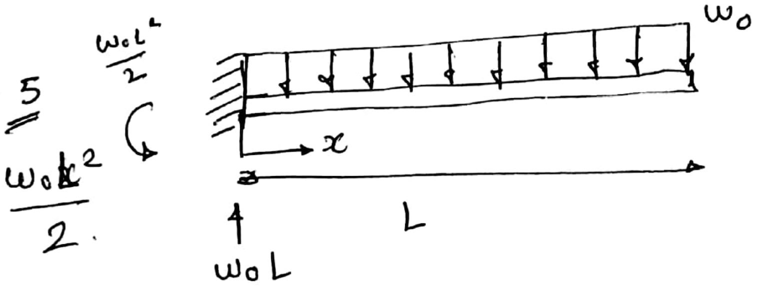


$$EI\frac{d^2y}{dx^2} = w_0Lx - \frac{w_0L^2}{2} - \frac{w_0x^2}{2}$$

$$EI\frac{dy}{dx} = \frac{w_0Lx^2}{2} - \frac{w_0L^2x}{2} - \frac{w_0x^3}{6} + C_1$$

$$EIy = \frac{w_0Lx^3}{6} - \frac{w_0L^2x^2}{4} - \frac{w_0x^4}{24} + C_1x + C_2.$$

$$y(0) = 0 \quad ; \quad \therefore C_2 = 0 \quad ; \quad y'(0) = 0 \quad ; \quad \therefore C_1 = 0$$

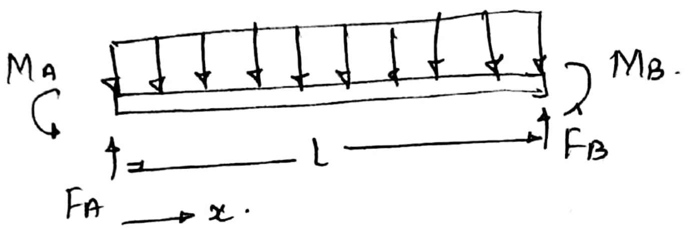
$$\therefore y = \frac{w_0}{24EI}\left[4Lx^3 - 6L^2x^2 - x^4\right]$$

6] $$y_{L/2} = \frac{w_0}{24EI}\left[4L\left(\frac{L}{2}\right)^3 - 6L^2\left(\frac{L}{2}\right)^2 - \left(\frac{L}{2}\right)^4\right]$$

$$= \frac{w_0}{24EI}\left[\frac{-17L^4}{16}\right]$$

$$= \frac{-17\,w_0 L^4}{384EI}$$

(7)



Equilibrium ; $\Sigma F_y = 0$

$$F_A + F_B = wL.$$

From Symmetry $F_A = F_B = \frac{wL}{2}$.

$$EI\frac{d^2y}{dx^2} = M_0 = \frac{wLx}{2} - \frac{wx^2}{2} - M_A.$$

$$EI\frac{dy}{dx} = \frac{wLx^2}{4} - \frac{wx^3}{6} - M_A x + C_1$$

$$EIy = \frac{wLx^3}{12} - \frac{wx^4}{24} - \frac{M_A x^2}{2} + C_1 x + C_2.$$

$y'(0) = 0$; $\therefore C_1 = 0$; $y(0) = 0$; $\therefore C_2 = 0$

$y(L) = 0$ ... from Boundary Conditions

$$\therefore 0 = \frac{wL \times L^3}{12} - \frac{wL^4}{24} - \frac{M_A L^2}{2}$$

$$\therefore M_A = \frac{wL^2}{12}.$$

$\therefore M_b = \frac{wLx}{2} - \frac{wL^2}{12} - \frac{wx^2}{2}$.

$\frac{dM_b}{dx} = 0$ @ $x = L/2$.

$\therefore M_b = \frac{wL^2}{24}$

$\therefore M_{max} = \frac{wL^2}{12}$.

$y_{L/2} = \frac{wL^4}{384EI}$.

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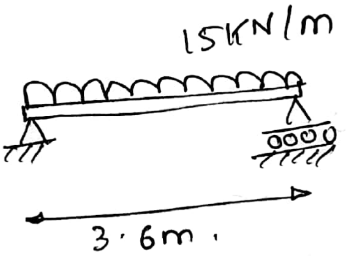

$V_{max} = \frac{wL}{2} = 27KN = R_A = R_B$.

$M_{L/4} = R_A \times \frac{L}{4} - 15 \times \left(\frac{L}{4}\right)^2 \times \frac{1}{2}$

$M_{L/4} = 18.225\,KNm$

$V_{L/4} = R_A - 15 \times (L/4) = 13.5\,KN$.

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$\delta_{max} = \frac{5}{384}\frac{wL^4}{EI} = \frac{1}{360} \times L$

$I = \frac{5 \times 360 \times wL^3}{384E} = \frac{5 \times 360 \times 15 \times 3.6^3}{384 \times 7 \times 10^9}$

$I_{min} = 4.686 \times 10^{-4}\,m^4$.

11)

$d = 3b.$

$$\frac{b \times d^3}{12} = 4.68 \times 10^{-4}.$$

$$\frac{b \times 27b^3}{12} = 4.68 \times 10^{-4}.$$

$b = 0.120m$

$b = 120mm.$