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ID 7933

SEC B

SUB Structure analysis

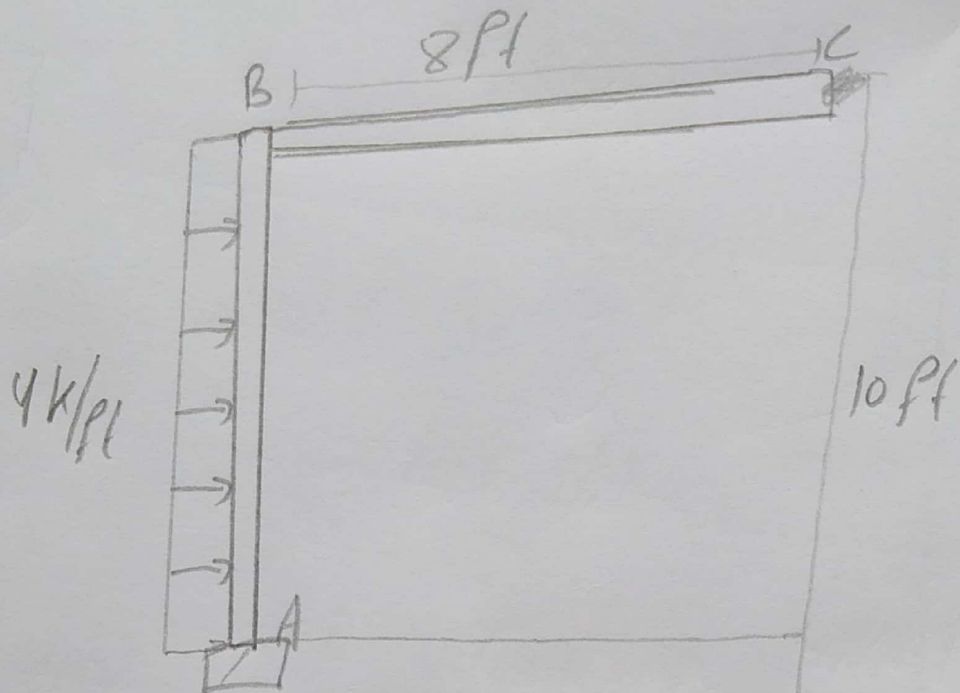
DePT Civil

Semister 4th

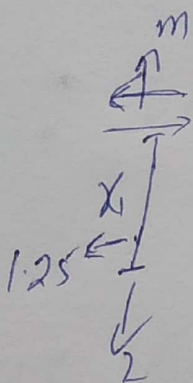
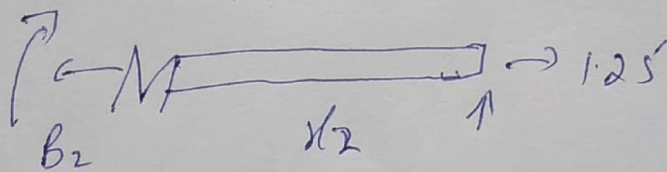
Exam Final term

(11)

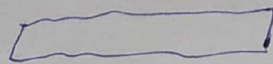
# Question No # (1)



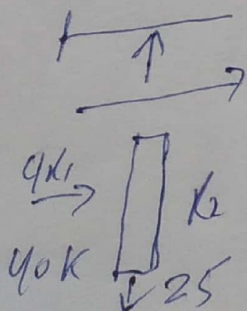
virtual moment



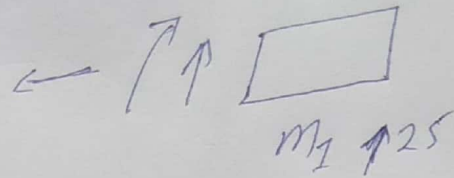
$$m_2 = 1.25x$$



real moment



(2)



$$m_2 = 25x_2$$

$$m_0 = \frac{40x_1 \cdot \frac{1}{2}x_1 (x_1)(x_1)}{4x_1 - 2x_3^2}$$

Now put virtual work equation

$$1 \cdot \Delta U = \int_0^L m \frac{M}{E} dx$$

$$\Delta U = \int_0^{10} \frac{1x_1 (40x_1 \times 2x_1^2)}{E} dx +$$

$$\int_0^8 \frac{(1.25x_2)(25x_2)}{E} dx_2$$

(3)

$$\Delta_L = \frac{1}{EI} \left( \frac{40x^3}{3} - \frac{2x^3}{4} \right) \Big|_0^{10} +$$

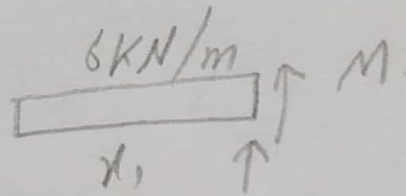
$$\left( \frac{31.25x^3}{3} \right) \Big|_0^8 \frac{1}{EI}$$

$$\Delta_L = 10649.60184$$

Ans.

①  
Question No = 02

Slope:



$$M + \frac{1}{2} x (6x) = 0$$

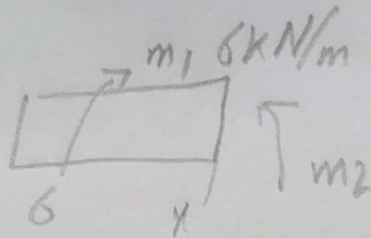
$$M = -\frac{1}{2} x (6x)$$

$$M = -3x^2$$

now we take partial  
derivative w.r.t  $m'$

$$\frac{2m}{2m'}$$

(2)



$$m'_1 - m_2 = \frac{1}{2} (x_2) (6 + x_2)$$

$$m = -m'_1 + \frac{6x_2 + x_2^2}{2}$$

$$m = -m'_1 + 3x^2 + \frac{x^2}{2}$$

Now we take partial derivative with w.r.t to  $m_2$ .

$$\frac{\partial m}{\partial m_2} = -1$$

$$\int_0^6 \frac{-3x^2(0)}{EI} dx + \int_0^6 \left(-1 + 6x^2 + \frac{x^2}{2}\right) dx \rightarrow \text{①}$$

$$\text{①} + \left(-x + \frac{6x^3}{3} + \frac{x^3}{6}\right) \Big|_0^6$$

(8)

$$\Rightarrow 0 + \left( -x + \frac{6x^3}{3} + \frac{x^3}{0} \right) \Big|_0^{10}$$

Taking L.C.M on eq ①

$$\Rightarrow \int_0^{10} \left( -1 + \frac{12x^2 + x^2}{2} \right) dx$$

$$\Rightarrow \int_0^{10} \left( -1 + \frac{13x^2}{2} \right) dx$$

$$-x + \frac{13}{2} \cdot \frac{x^3}{3} \Big|_0^{10}$$

$$-x + \frac{13}{6} x^3 \Big|_0^{10}$$

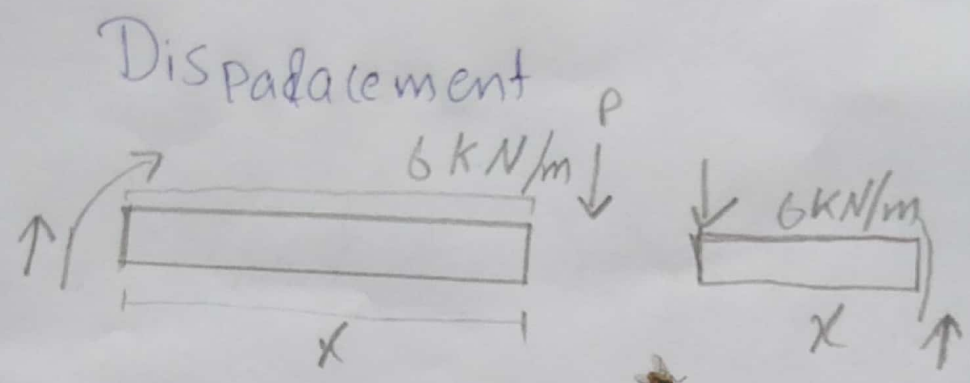
$$\left( 10 + \frac{13}{6} (10)^3 \right) - \left( 0 + \frac{13}{6} (0) \right)$$

(4)

$$4.125 \times 10^{-7} \text{ inch}$$



Q5



$$-m - \frac{1}{2}(x)(6x) - Px = 0,$$

$$m + \frac{1}{2}(x)(6x) + Px = 0$$

$$m = -3x^2 - Px, \quad m = -3x^2 - Px$$

Partial derivatives

$$\frac{\partial m}{\partial P} = -x \quad \frac{\partial m}{\partial P} = -x$$

$$\Delta B = \int_0^x \frac{m(\partial m)}{\partial P} \frac{dx}{EI}$$

(6)

$$\Delta B = \int_0^2 \frac{-3x^2(-x) dx}{EI} + \int_0^4 \frac{-3x^2(-x) dx}{EI}$$

$$\Rightarrow \frac{-3x^4}{4EI} \Big|_0^6 + \frac{-3x^4}{4EI} \Big|_0^4 \rightarrow a$$

Put value of E, I and

eq (a)

$$\Rightarrow \frac{+3x^4}{4(200 \times 10^9)(60 \times 10^6)} \Big|_0^6 + \frac{+3x^4}{4(200 \times 10^9)(60 \times 10^6)}$$

$$\left( \frac{3(6)^4}{4(200 \times 10^9)(60 \times 10^6)} - \frac{3(0)^4}{4(200 \times 10^9)(60 \times 10^6)} \right) +$$

$$\left( \frac{3(4)^4}{4(200 \times 10^9)(60 \times 10^6)} - \frac{3(0)^4}{4EI} \right)$$

(7)

$$\frac{3(6)^4}{4EI} + \frac{3(4)^4}{4EI}$$

Taking L.C.M

$$\frac{3(6)^4 + 3(4)^4}{4(E)(I)}$$

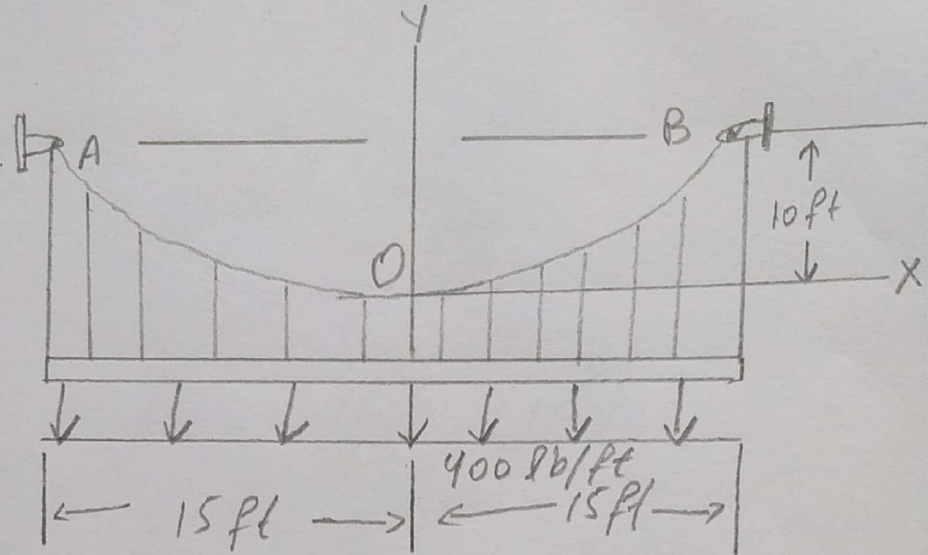
$$= \frac{3(1296) + 3(256)}{4(E)(I)}$$

$$\Rightarrow \frac{4656}{4(200 \times 10^9)(60 \times 10^6)}$$

$$\boxed{9.7 \times 10^{-7} \text{ Ans}}$$

(1)

# Question NO # 03



Sol:

we know that

$$Y = \frac{h}{L^2} x^2$$

$$Y = \frac{10}{(15)^2} x^2$$

(2)

$$y = 0.0444 x^2$$

from eq of

$$T_A = F_H = \frac{w_0}{2h} L^2$$

$$F_H = \frac{400 (15)^2}{2(10)}$$

$$F_H = 4500$$

from eq of

$$T_B = T_{\max} = \sqrt{F_H^2 + (w_0 L)^2}$$

$$\Rightarrow T_{\max} = \sqrt{(4500)^2 + (400 \times 15)^2}$$

$$\Rightarrow 7500 = 7.5k$$

(3)

Also from eq.

$$T_{\max} = W_0 L \sqrt{1 + \left(\frac{L}{2h}\right)^2}$$

$$T_{\max} = 400(15) \sqrt{1 + \left(\frac{15}{2(10)}\right)^2}$$

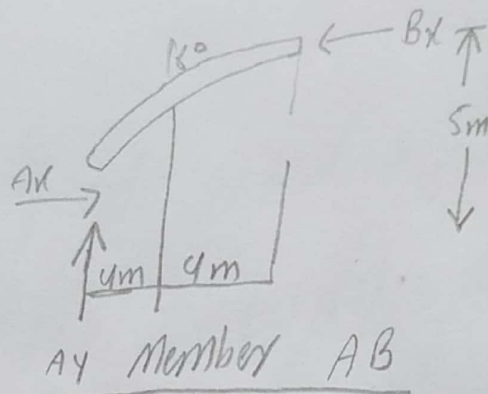
$$T_{\max} = 7500 = 7.5 \text{ k}$$

(1)

# Question No # 04

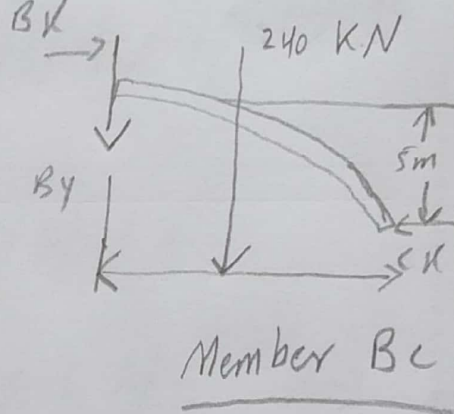
Given data:

uniform load  
 $\Rightarrow 30 \text{ kN/m}$



Req:

Internal moment  
at D = ?



Sol:

Dividing into two  
member AB and BC

AB

$$\downarrow + \sum M_A = 0 \quad B_x(5) + B_y(8) - 240(4) = 0 \quad \rightarrow \textcircled{1}$$

(2)

Bc

$$\left( \begin{array}{l} + \sum M_c = 0 \\ -B_x(5) + B_y(8) + 240(4) = 0 \end{array} \right) \rightarrow (2)$$

Adding eq (1) and (2)

$$B_x(5) + B_y(8) - 240(40) = 0$$

$$-B_x(5) + B_y(8) + 240(40) = 0$$

---

$$2B_y(8) = 0$$

$$\Rightarrow B_y = 0 \text{ kN}$$

Put the value of  $B_y$  in

eq (2)

$$\Rightarrow -B_x(5) + 0(8) + 240(4) = 0$$

$$\Rightarrow -B_x(5) + 960 = 0$$



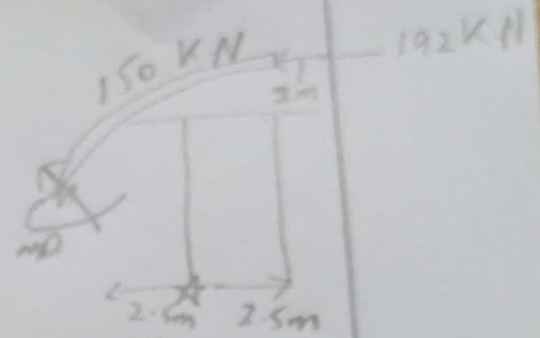
(3)

$$B_x(5) = 960$$

$$B_x = \frac{960}{5}$$

$$B_x = 192 \text{ K.N}$$

Member  
BD



"Now at Segment DB"

$$\sum M_D = 0$$

$$192(2) - 150(2.5) - M_D = 0$$

$$\Rightarrow 384 - 375 - M_D = 0$$

$$\Rightarrow 9 - M_D = 0$$

$$\Rightarrow M_D = 9 \text{ K.N}\cdot\text{m}$$