

ASSIGNMENT : ①

STRUCTURAL  
ANALYSIS

No : 3

NAME:

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ID:

7968

SECTION:

B

DATE:

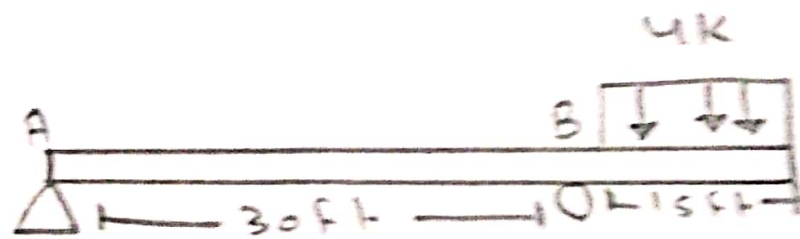
11-07-2020

SUBMITTED TO:

Sir: AMJAD ISLAM

Ans OF Q No 1: <sup>(2)</sup>

DIAGRAM:



SOLUTION:

$$\uparrow + \sum M_A = 0$$

$$-V_B \times 30 + (4 \times 15) \times 3.75 = 0$$

$$V_B = 75 \text{ k}$$

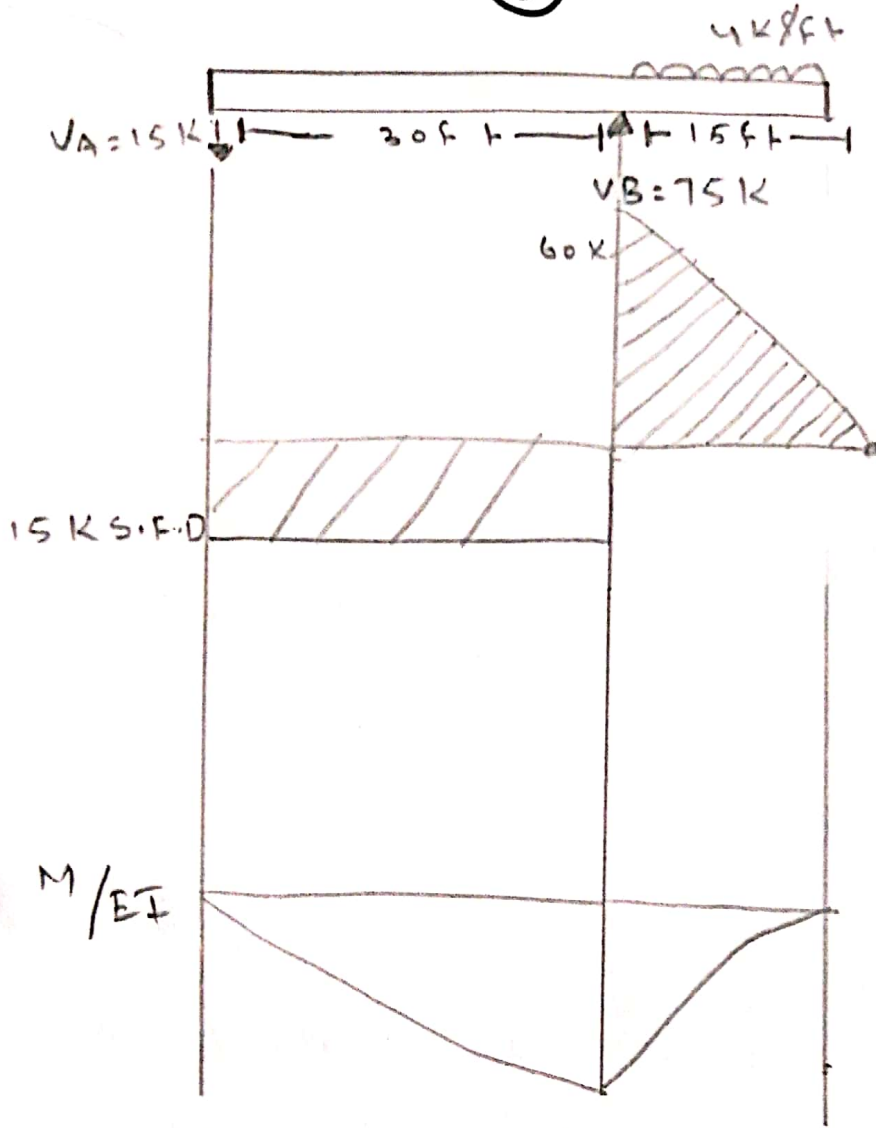
$$V_B = 75 \text{ k}$$

$$\downarrow \sum M_B = 0$$

$$V_A \times 30 + (4 \times 15) \times 7.5 = 0$$

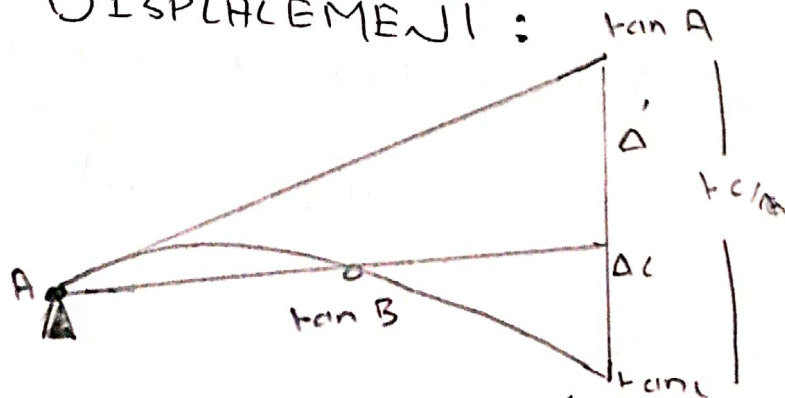
$$V_A = -15 \text{ k}$$

3



Thus  $M/EI$  consist of triangular and parabol segment

FOR DISPLACEMENT:



$$\Delta_{c/A} = \Delta_c + \Delta'$$

(4)

$$\Delta_c = t_{C/A} - \Delta' \rightarrow (1)$$

$$\frac{\Delta'}{45} = \frac{t_{B/A}}{30}$$

$$\Delta' = \frac{3}{3} t_{B/A}$$

eq (1)

$$t_{C/A}: \Delta_c = t_{C/A} - \frac{3}{2} t_{B/A}$$

$$t_{C/A} = \left[ \frac{-450}{EI} \times 30 \times \frac{1}{2} \right] \times \left[ 15 + \frac{1}{3} \times 30 \right] + \left[ \frac{3}{4} \times 15 \right] \times \left[ \frac{1}{3} \times \frac{450}{EI} \times 15 \right]$$

$$t_{C/A} = \frac{168750}{EI} - \frac{25312.5}{EI}$$

$$t_{C/A} = -194062.5/EI$$

For  $t_{B/A}$ :

$$t_{B/A} = \left[ \frac{-450 \times 30}{EI} \right] \times \left[ \frac{1}{3} \times 30 \right]$$

$$t_{B/A} = -67500/EI$$

⑤

$$\Delta_c = \frac{-19406.5}{2} - \left( \frac{67500}{EI} \right) \times \frac{3}{2}$$

$$\Delta_c = \frac{-295312.5}{EI} \quad \text{K-ft}^3$$

For SLOPE AT POINT B:

$$\begin{aligned} \theta_B &= \frac{\Delta_c}{15} \\ &= \left( \frac{295312.5}{EI} \right) / 15 \end{aligned}$$

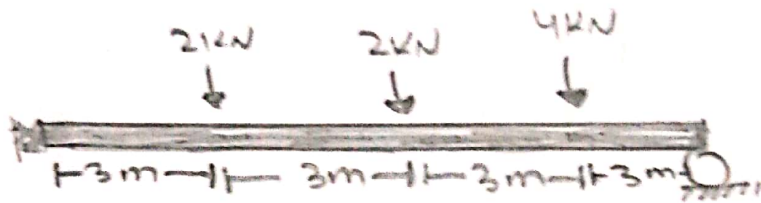
$$\theta_B = 19687.5 / EI \quad \text{K/ft}^3$$

Slope of the free end at Point C is near equal to zero.

⑥

Ans OF Q No 2:

DIAGRAM:



SOLUTION:

As the beam is symmetrical

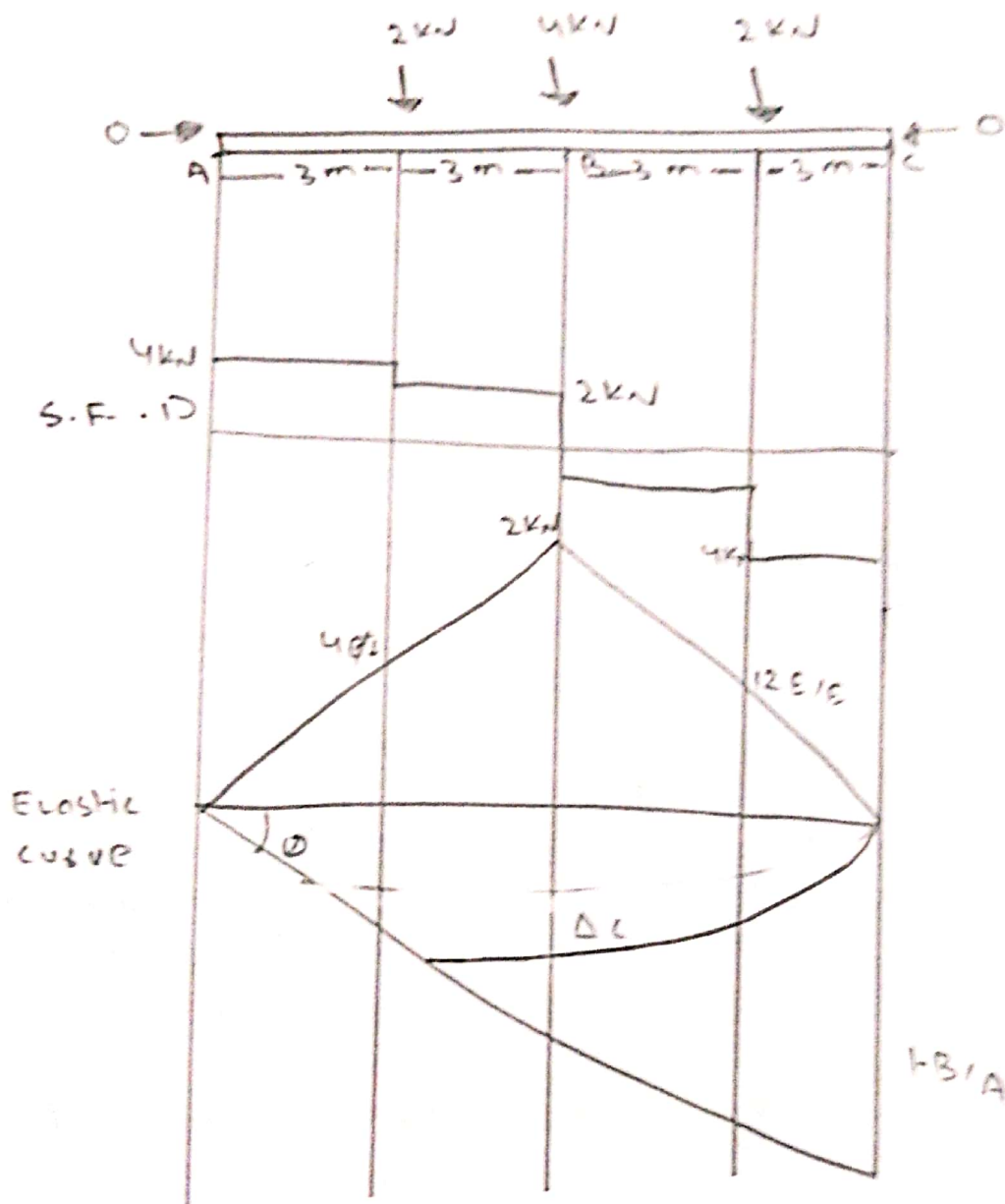
So

$$V_A = V_B = (2 + 4 + 2) / 2$$

$$V_A = V_B = 4 \text{ kN}$$

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7



$$\theta_A = \tan^{-1} \frac{t_{B/A}}{120} \rightarrow \text{①}$$

$$\theta_A = \frac{\Delta C + t_{C/A}}{6}$$

$$\Delta C = 6\theta_A - t_{C/A} \rightarrow \text{②}$$

Now for slope:

$$t_{B/A} = \int_0^B \frac{M}{EI} \bar{x}$$



$$\textcircled{8}$$

$$t_{B/A} = \frac{1}{EI} \left[ \left( \frac{18 \times 6}{2} \right) \left( \frac{2}{3} \times 6 \right) + \left( \frac{18 \times 6}{2} \right) + \left( \frac{6 \times 6}{3} \right) \right]$$

$$t_{B/A} = \frac{1}{EI} [216 + 432]$$

$$t_{B/A} = 648 / EI$$

$$Q_A = \frac{648}{EI} / 12$$

$$Q_A = 54 \text{ kN-m}^2$$

$$= 2000 \times 10^9 \times \frac{6 \times 10^6}{(6000)^4}$$

$$Q_A = 0.045 \text{ (600 anticlockwise)}$$

Now For displacement:

$$t_{C/A} = \frac{1}{EI} \left[ \left( \frac{18 \times 6}{2} \right) \times \left( \frac{1}{3} \times 6 \right) \right]$$

$$t_{C/A} = \frac{108}{EI} \text{ kN-m}^2$$

$$\Delta_C = \frac{6 \times 54}{EI} = \frac{108}{EI}$$

$$\Delta_C = \frac{324 - 108}{EI}$$



9)

$$\Delta_c = \frac{216}{EI}$$

$$\Delta_c = \frac{216}{EI}$$

$$\Delta_c = 0.18 \text{ m}$$

$$\Delta_c = 0.18 \text{ m}$$

$$\Delta_c = 18 \text{ cm} \downarrow$$

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