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SECTION B

DEPARTMENT BE(C)

SUBJECT STRUCTURAL ANALYSIS

SEMESTER 4th

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ASSIGNMENT

QUESTION No 01

Determine the slope at point ..... Use the moment-area theorem?

TO FIND

We have to find the slope

SOLUTION

As we know that

$\Sigma M_A = 0 \; +\circlearrowleft$

$\Rightarrow F_B(30) - (60 \times 37.5) = 0$

$$\boxed{F_B = 75\,K}$$

Now $\Sigma F_y = 0 \; +\uparrow$

$\Rightarrow F_A + 75\,K - 60\,K = 0$

$F_A = -15\,K$

Now $\theta_{CA} = \frac{1}{2}\left(\frac{-750\,K.ft}{EI}\right)(45ft)$

$$= \frac{33750\,K\,ft^3}{2EI}$$

$$= \frac{16875}{EI}\,K.ft^2$$

$$|t_{B/A}| = \left[\frac{1}{2}\left(\frac{750\,k.ft}{EI}\right)30\,ft\right]\left[\frac{1}{3}(30\,ft)\right]$$

$$= \frac{11250}{EI}\,k.ft^3$$

$$t_{C/A} \left[\frac{1}{2}\left(\frac{750\,kft}{EI}\right)30\,ft\right]\left[15\,ft + \frac{1}{3}(30\,ft)\right] + \left[\frac{1}{2}\left(\frac{750\,kft}{EI}\right)(15\,ft)\right]\left[\frac{2}{3}(15\,ft)\right]$$

$$= \frac{281250\,k\,ft^3}{EI} + \frac{56250}{EI}\,k.ft^3$$

Thus

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

$$= \frac{45}{30}\left(\frac{112500}{EI}\,k.ft^3\right)$$

$$= \frac{168750}{EI}\,k\,ft^3$$

$$\theta_A = \frac{|t_{B/A}|}{t_{AB}} = \frac{112500/EI}{30\,ft}$$

$$= \frac{3750}{EI}\,k.ft^2$$

$$+\circlearrowleft\ \theta_C = \theta_A + \theta_{C/A}$$

$$\theta_C = -\frac{3750}{EI}\,k\,ft^3 + \frac{16875}{EI}\,k\,ft^3$$

2) $\theta_c = 13\ 125\ k\,ft^3$

$$\Delta_c = |t_{CA}| - \Delta'$$

$$= \frac{337500\ k\,ft^3}{EI} - \frac{168750\ k\,ft^3}{EI}$$

$$\boxed{\Delta_c = \frac{168750\ k\,ft^3}{EI}}$$

QUESTION No 02 :~

Determine the slope at A and displacement ------ Take $E = 200\,GPa$, $I = 6(10^6)\,mm^4$

SOL :~

$$E = 200\ GPa$$

$$I = 6(10^6)\ mm^4$$

Now

$$\theta_{A/C} = \frac{1}{2}\left(\frac{12}{EI} \times 3\right) + \left(\frac{12}{EI} \times 3\right) + \frac{1}{2}\left(\frac{6}{EI} \times 3\right)$$

$$= \frac{18}{EI} + \frac{36}{EI} + \frac{9}{EI}$$

$$= \frac{63}{EI} = \frac{63}{(200 \times 10^6)(6 \times 10^6)(1/1000)^4}$$

$$\boxed{\theta_A = 0.0525 \text{ radian}}$$

$$t_{A/C} = \frac{1}{2}\left(\frac{12}{EI} \times 3\right)\left(\frac{2}{3} \times 3\right) + \left(\frac{12}{EI} \times 3\right)\left(3 + \frac{1}{2} \times 3\right) + \frac{1}{2}\left(\frac{6}{EI} \times 3\right)\left(3 + \frac{2}{3} + 3\right)$$

$$t_{A/C} = 0.202\ m$$

$$\Delta_C = t_{A/C} = 0.202\ m$$

or

$$\boxed{\Delta_C = 202\ mm}$$