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Section B

Deptt BE(C)

Semester 4th

Assignment Column and beam

Subject Structure Analysis

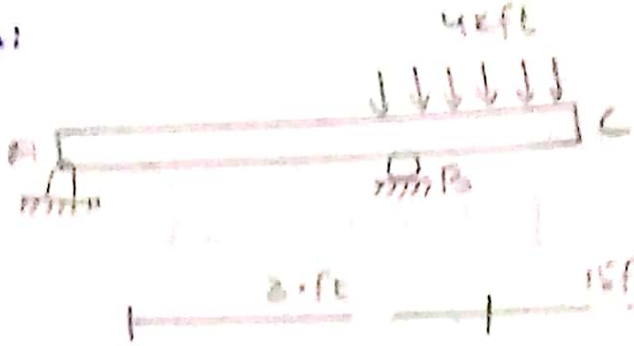
Submitted to Engr Amjad Islam

IQRA National University.

Question No. 1

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

Given data:



Required data:

We have to find the slope.

Solution:

As we know that

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

$$\Rightarrow (F_B \times 20) - (60 \times 37.5) = 0$$

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

Now:

$$\Sigma F_y = 0 \quad +\uparrow$$

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

$$\Rightarrow \boxed{F_A = -15K}$$

Now

$$\theta_{C/A} = \frac{1}{2}\left(-\frac{750K \cdot ft}{EI}\right)(45ft) = \frac{33750K \cdot ft^2}{2EI}$$

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

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

$$\theta_C = -\frac{3750}{EI}\ k\cdot ft^2 + \frac{16875\ k\cdot ft^2}{EI}$$

$$\Rightarrow \theta_C = \frac{13125\ k\cdot ft^2}{EI}$$

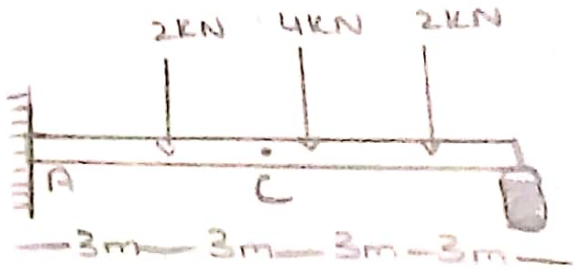
$$\theta_C = |t_{C/A}| - \theta' = \frac{337500\ k\cdot Ft^3}{EI} - \frac{168750\ k\cdot f}{EI}$$

$$\boxed{\theta_C = \frac{168750\ k\cdot ft^2}{EI}}$$

Question No. 2

Determine the slope at point ------ take E = 200GPa, $I = 6\times10^6\ mm^4$

Given data:



$E = 200GPa$

$I = 6\times10^6\ mm^4$

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

$$= \frac{112500}{EI}\ k\cdot ft^3$$

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

$$= \frac{281250\ k\cdot ft^3}{EI} + \frac{56250\ k\cdot ft^3}{EI} \Rightarrow \frac{337500\ k\cdot ft^3}{EI}$$

Then

$$\theta' = \frac{45}{30}\left(t_{B/A}\right)$$

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

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

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

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

Solution:

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

$$\Rightarrow \theta_{A/C} = \frac{63}{EI}$$

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

$$\Rightarrow \theta_{AC} = 0.0525 \text{ radians}$$

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

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

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

$OC = 202\,mm$

Result:

$OC = 202\,mm.$