Name : Muhammad Sulaiman

ID & section: 7925 (A)

Assignment 03

Structural analysis

Engr Amjad Aslam

4th semester

BE civil

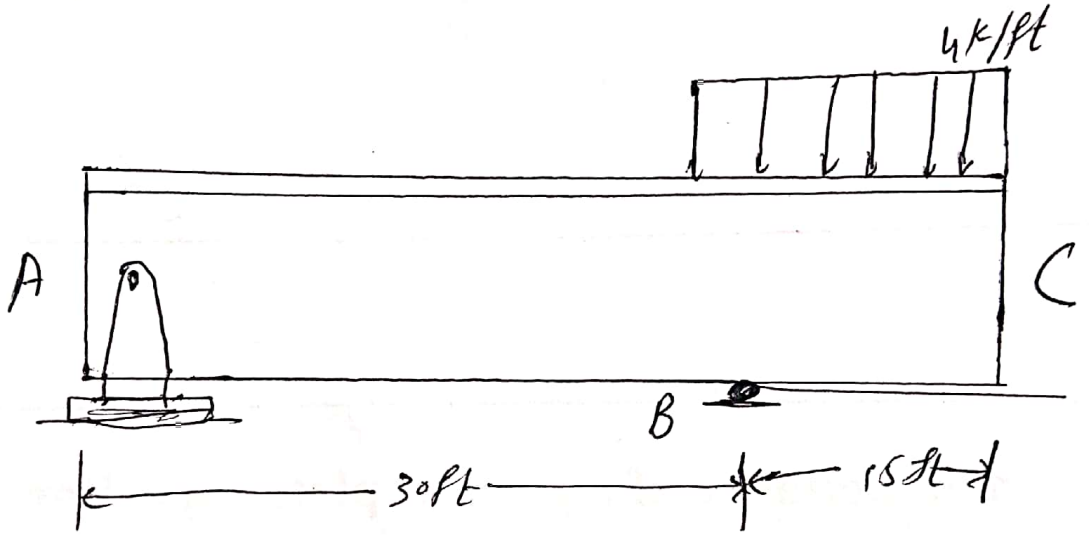
P – 1

Assignment # 3rd

Conjugate Beam Method

Q#1) Determine the slop and displacement C, EI is constant.

Use the moment Area theorms



Solution : $+\circlearrowleft \sum M_A = 0$

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

$$V_B = 75K$$

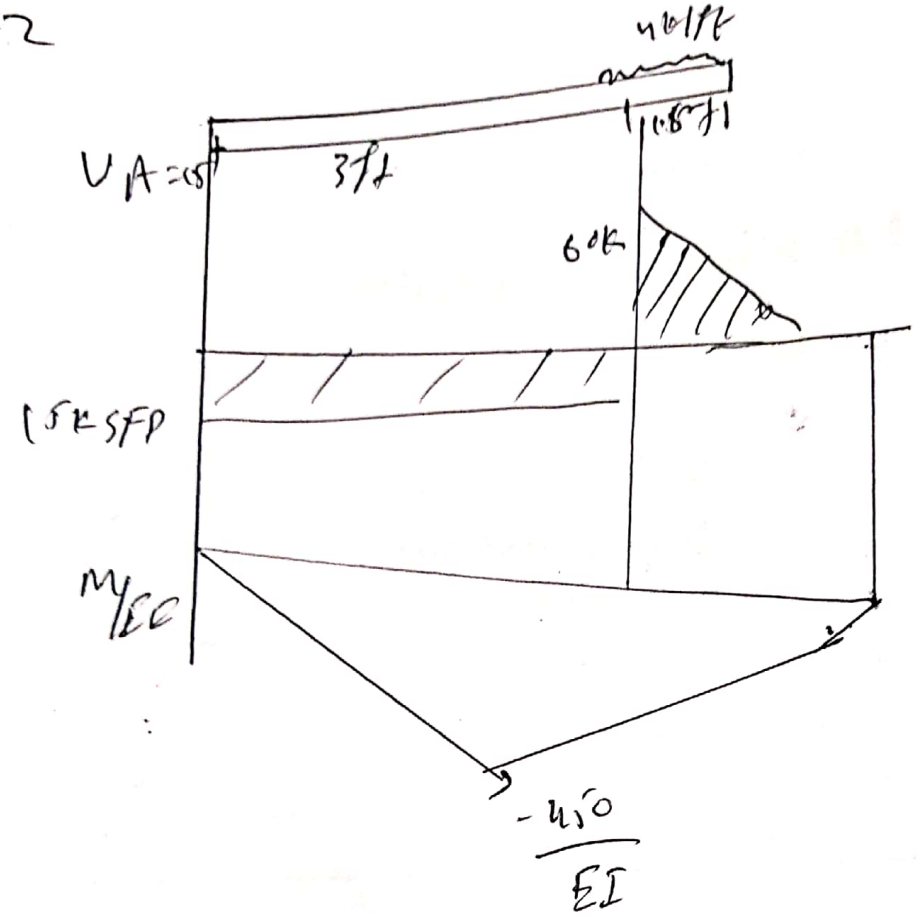
$$V_B = 75K$$

$$\downarrow \sum M_B = 0$$

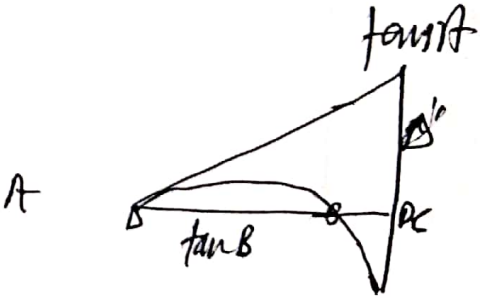
$$V_A \times 30 + (4 \times 15) \times 75 = 0$$

$$V_A = -15K$$

P-2



Thus M/EI consist of triangle and Parabol segment



→ For Displacement

$t_{C/A} = DC + D'$

$DC = \frac{t_C}{A} - D' \longrightarrow (1)$

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

P-3

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

eqn (1)

$$D_C = \frac{t_C}{A} - \frac{3}{2} + t_{B/A}$$

$t_{C/A}$:

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

$$\times \left[\frac{1}{3} \times \frac{450}{EI} \times 15\right]$$

$$\frac{t_C}{a} = \frac{168750}{EI} - \frac{25312.5}{EI}$$

$$\frac{t_C}{a} = -194065/EI$$

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

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

P-4) $DC = \frac{-19406.5}{2} - \left(\frac{67500}{EI}\right) \times \frac{3}{2}$

$DC = \frac{-295312.5}{EI}\ K/ft^3$

For Slope at B

$OB = \frac{DC}{15}$

$OB = \left(\frac{295312}{EI}\right) / 15$

$OB = \frac{19687.5}{EI}\ K/ft^3$

Slope of the force ent at point EC is nearly equal to zero

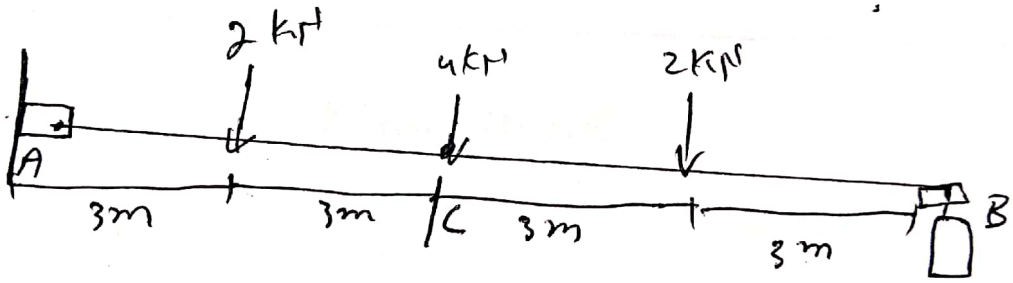
Assignment #3

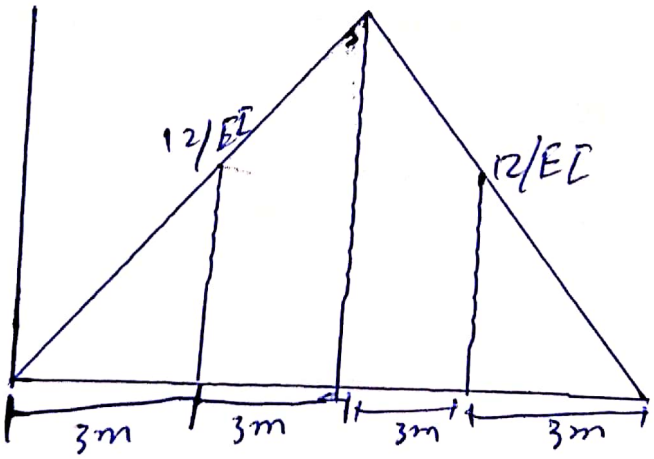
Q#2 :

Determine the slop at A and Displacement at C of the beam in the figure moment area theorm Take E = 200 Gpa

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

Solution :





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

$$\theta_{A/C} = \left(18/EI\right) + \left(36/EI\right) + \left(9/EI\right)$$

$$\theta_{A/C} = \frac{63}{EI} \Rightarrow 63/(200\times10^{6})(6\times10^{8})(100)^{-12}$$

$$\theta_{A/C} = 0.0525 \text{ rad}$$

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

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

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

$$\left(3+\frac{1}{2}(3)\right] + \left[\frac{1}{2}\left[\frac{6}{EI}\right](3)\right]\left(3+\frac{2}{3}(3)\right]$$

$$= 0.202\text{m}$$

So

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

$$= 202\text{mm} \quad \text{Ans}$$