Name Usama Khaleeq

ID 7983

Section B

Paper Structural Analysis-I

Exam

Q no 1:

$\Delta_{cn} = ?$

$E = 29 \times 10^3$ ksi $: 4$ kip/in

$I = 600 in^4$

Solution:

Finding

$= -4(10)(8) + C_y(8) = 0$

$C_y = 5$ kip

$F_y = 0$

$35 + A_y = 0$

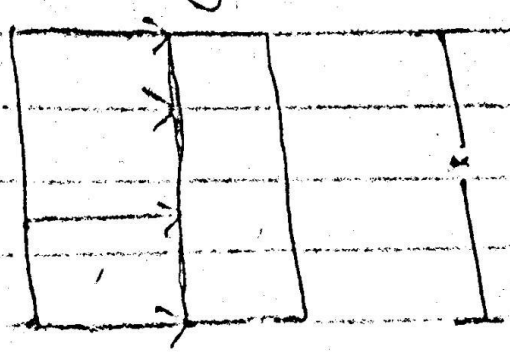
$A_y = -35$ kips

$F_x = 0$

$40 - A_x = 0$

$A_x = 40$ kips

Taking section:



Real moments:

$$-40(x_1) + 4x_1(x_2) + m = 0$$

$$m_1 = 40x_1 = 2x_1^2$$

Q no 8:

Given:

E = 200 GPa

I = 60×10^6

Required:

Slope = ?

Displacement = ?

Solution:

$m_1 = -m_2 = \frac{1}{2}(x_1)(6 \times x_1)$

$m_1 = m' + \frac{6x_1 \times x_1^2}{2}$

$m = -m' + 3x^2 + x_1^2/2$

Taking $\int$

$\frac{\partial m_1}{\partial P} = -x$

$AB = \int_0^L \frac{m(P=0)}{EI} \frac{\partial M}{\partial P} dx$

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

$AB = \frac{-3x^4}{4EI} \Big|_0^3 + \frac{-3x^4}{4EI} \Big|_0^3$

putting values.

$$\frac{-3x^3}{2(200\times 60\times 10^4)}\Big|_0^{\frac{1}{3}} + \frac{-3x^4}{4(200)(60\times 10^4)}\Big|_0^{\frac{1}{3}}$$

$$= \frac{-216\ kN\ ft^3}{4.8\times 10^6} + \frac{-6.14\ kN\ ft^3}{4.8\times 10^6}$$

$$= -4.5\times 10^{-9} + (-1.28\times 10^{-3})$$

$$\Delta B = 5.76\times 10^{-10}\ inch.$$

Now slope:

$$m + \tfrac{1}{2}\times(6x_1) = 0$$

$$m = -\tfrac{1}{2}\times(6x_2) = 3x^2$$

$$\text{So} \quad \frac{\partial m_1}{\partial m_1} = 0$$

$$\frac{\partial m_2}{\partial m_1}$$

$$m_1 - m_2 = -\frac{1}{2}(x_2)(6+x_1)$$

$$m_2 = m' + 6x_2 + x_2^2$$

$$m_2 = -m' + 3x^2 + x_2^2$$

$$\frac{\partial m_2}{\partial m_1} = 1$$

$$\left[\frac{-3x^2(4)}{E\cdot I}\right]_0^{\frac{1}{3}} + \left[(-2 + 6x^2 + x_2^2)\,dx\right]_0^{\frac{1}{3}}$$

$$= 0 + \left(-x + \frac{6x^2}{3} + \frac{x^3}{6}\right)\Big|_0 \left(\frac{1}{EI}\right)$$

$$= \frac{1}{2\times10^4(50\times10^6)}\left(-x + \frac{6x^3}{3} + \frac{x^{3\times10}}{6\times3}\right)$$

$$= 4.125 \times 10^{-2} \text{ inch}$$

Q no 3:

Solution: $y = \frac{h}{L^2} x^2 = \frac{10}{(15)^2} x^2$

$$y = 0.044 x^2$$

$$F_B = \frac{w_0 L^2}{2h}$$

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

$$= 4500 \text{ lb}$$

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

$$= \sqrt{(4500)^2 + [(400(15)]^2}$$

$$= 7500 \text{ lb} = 7.50 \text{ k}$$

Now:

$$T_B = T_{max} = w_0 L \sqrt{1 + \left(\frac{L}{2h}\right)^2}$$

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

$$\Rightarrow 7500 \text{ lb} = 7500 \text{ lb}$$

Ans4:

Given:

uniform load = 30 kN/m

Required:

Internal moment at D?

Solution:

Two members.

AB , BC.

AB : $C_1 + \Sigma M_B = 0$ $\quad Bx(5) + By(3) - 240(4) =$

BC:

$C_1 + M_C = 0$ $\quad -Bx(5) + By(3) + 240(4) = 0$

$Bx(5) + By(3) - 240(4) = 0$

$-Bx(5) + By(3) - 240(4) = 0$

$0 + 2By(1) + 0 = 0$

$2By(3) = 0$

$By = 0$ kN

$-Bx(5) + 0(3) + 960 = 0$

$Bx(5) = 960$

$\frac{Bx(5)}{5} = \frac{960}{5}$

$B_x = 192kN$

At segment DB

$C_1 + M_D = 0$

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

$384 - 375 - M_D = 0$

$9 - M_D$

$M_D = 9 kN \cdot m$