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Submitted to Sir Engr Sajib

Subject Structure Analysis 1

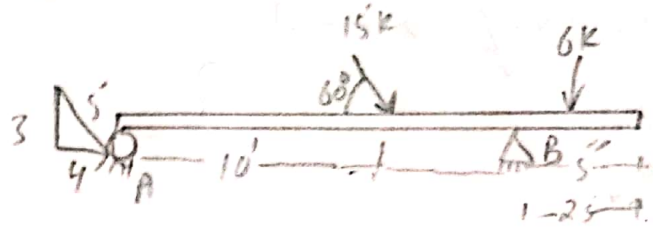
Semester 4th

Section B

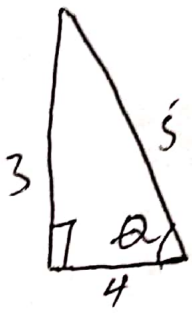
Date 22-08-020

Q:No:01

Determine the support reactions in the beam below in figure 1 the .... is given in figure.



Sol:- First of all we have to find the angle for the roller support.



:- Using Trigonometry

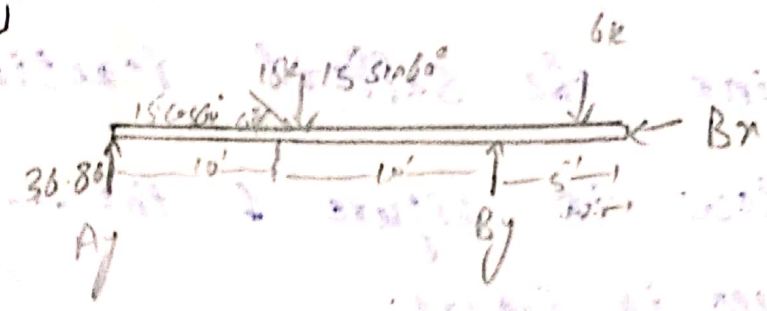
$$\sin\theta = \frac{P}{H}$$

$$\sin\theta = \frac{3}{5}$$

$$\theta = \sin^{-1}\left(\frac{3}{5}\right)$$

$$\theta = 36.86^{\circ}$$

So Now



1. $\Sigma F_x = 0$ $\xrightarrow{+}$ $\xleftarrow{-}$

$15\cos 60^\circ - B_x - A_y \sin 36.86^\circ = 0$

$7.5 - B_x - 0.599 A_y = 0$ — ①

2. $\Sigma F_y = 0$ $\uparrow +$ $\downarrow -$

$A_y \cos 36.86 + B_y - 6k - 15\sin 60^\circ = 0$

$0.80 A_y + B_y - 18.99 = 0$

$0.80 A_y + B_y = 18.99$ — ②

3) $\Sigma M = 0$ $\curvearrowright +$ $\curvearrowleft -$

$(A_y \cos 36.86 \times 20) - (15\sin 60^\circ \times 10) + 6 \times 2.5 = 0$

$16 A_y - 190 + 15 = 0$

$16 A_y - 175 = 0$

$A_y = \frac{175}{16}$

$\boxed{A_y = 10.9375\ k}$

Put the value in eq (2)

$$0.80(10.9375) + By = 18.99$$

$$8.75 + By = 18.99$$

$$By = 18.99 - 8.75$$

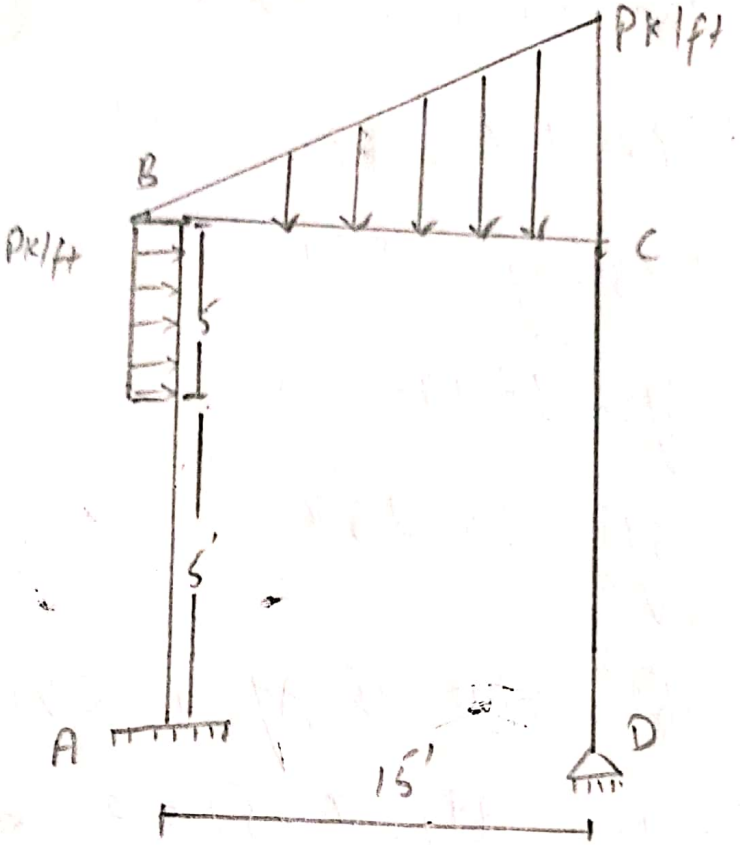
$$By = 10.25\,K$$

Put the value of Ay in eq (1)

$$7.5 - Bx - 0.599(10.9375) = 0$$

$$\boxed{Bx = 0.9375\,K}$$

Q.NO:. 02



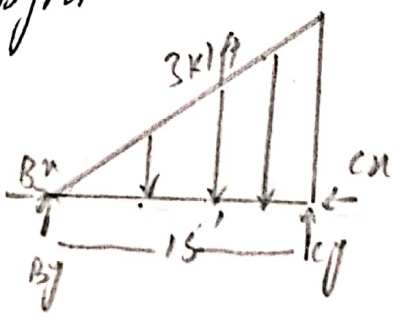
Sol:

ID = 7883

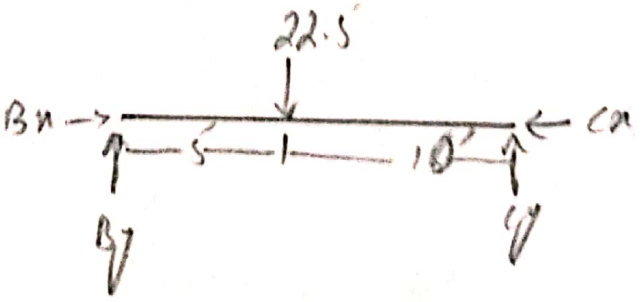
S.No 23

1) Free body diagram

UVL



F.B.D.



$$\text{Area} = \frac{1}{2} bh$$

$$= \frac{1}{2} (15 \times 3)$$

$$= 22.5$$

$$\text{Dist} = \frac{1}{3}(b) = \frac{1}{3}(15) = 5'$$

i- $\Sigma F_x = 0 \rightarrow + \leftarrow -$

$$B_x - C_x = 0 \quad -①$$

ii) $\Sigma F_y = 0 \uparrow + \downarrow -$

$$B_y + C_y = 22.5k \quad -②$$

iii- $\Sigma M_B = 0 \curvearrowright + \curvearrowleft -$

$$(22.5 \times 5) - C_y \times 15 = 0$$

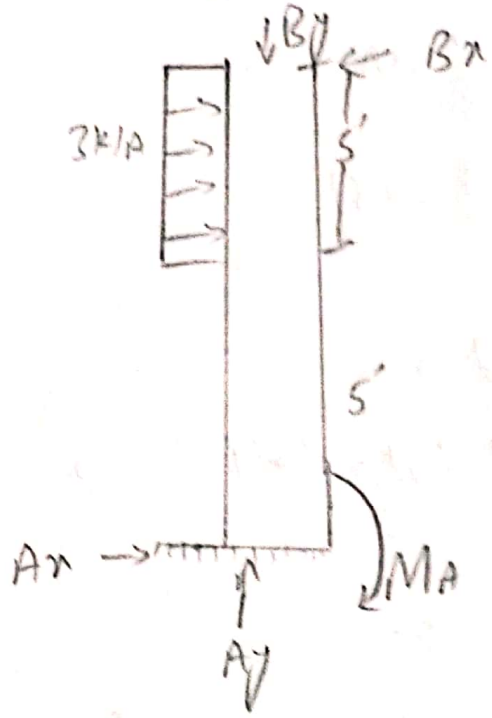
$$112.5 = 15 C_y$$

$$\boxed{C_y = 7.5k}$$

Put the value in eq (2)

$$B_y + 7.5 = 22.5$$

$$\boxed{B_y = 15k}$$



i) $\Sigma F_x = 0 \quad \rightarrow + \leftarrow$

$A_x + (3 \times 5) - B_x = 0$

$A_x - B_x = -15$ — (3)

ii) $\Sigma F_y = 0 \quad \uparrow + \downarrow -$

$A_y - B_y = 0$

iii) $\Sigma M_2 = 0 \quad \circlearrowleft + \circlearrowright$

$(3 \times 5) \times (2.5 + 5) - B_x \times 10 = 0$

$15 \times 7.5 = 10 B_x$

$$\boxed{B_x = 11.25 k}$$

Put the value in eq (3)

$A_x - 11.25 = -15$

$$\boxed{A_x = -3.75 k}$$

Now since C and D are at same line thus load is transferred so

$$Cy = 7.5\,k$$

so $\boxed{Dy = -7.5\,k}$

put the value of By in (4)

$$Ay - 15 = 0$$

$$\boxed{Ay = 15\,k}$$

Put the value of Bx in eqn (1)

$$11.25 - Cx = 0$$

$$\boxed{Cx = 11.25\,k}$$

So $\boxed{Dx = -11.25\,k}$

$$M_B = 0 \curvearrowright +$$

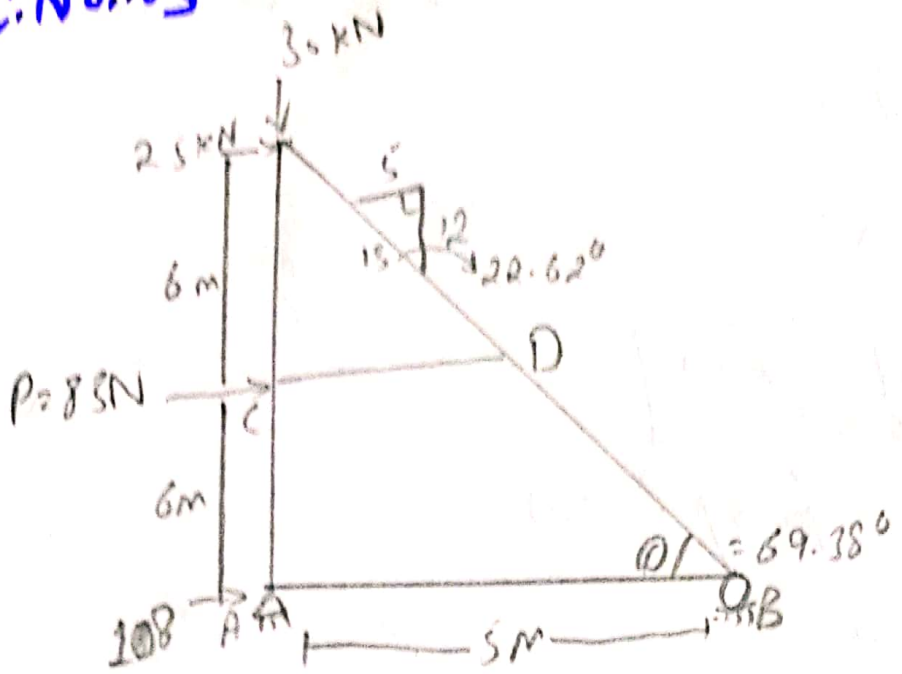
$$-(3\times5)(2.5) - (Ax\times10) + M_A = 0$$

$$-(37.5) - (-3.75)\times10) + M_A = 0$$

$$-37.5 + 37.5 + M_A = 0$$

$$\boxed{M_A = 0}$$

Q:No:03



$\sin\theta = P/H$

$\theta = \sin^{-1}(\frac{5}{13})$

$\theta = 22.62$

$\theta = ?$

Sol: $\Sigma M_A = 0$ ↺+

$(25 \times 12) - (B_y \times 5) + (83 \times 6) = 0$

$300 + 498 = 5B_y$

$\boxed{B_y = 159.6\,N}$

$\Sigma F_y = 0$ ↑+ ↓-

$A_y + B_y - 30 = 0$

$A_y + 159.6 - 30 = 0$

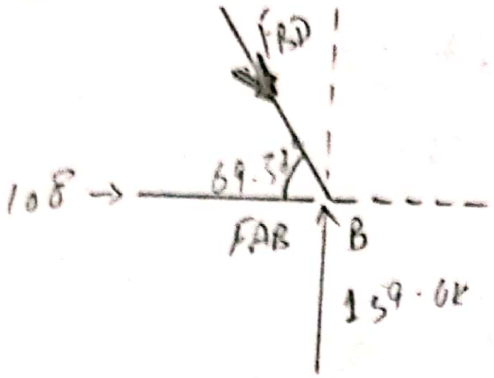
$\boxed{A_y = -129.6\,N}$

$\Sigma F_x = 0$ →+ ←-

$25 + 83 + A_x = 0$

$\boxed{A_x = -108\,N}$

Joint B :



$\Sigma F_x = 0 \rightarrow + \leftarrow$

$108 - F_{AB} = 0$

$\boxed{F_{AB} = 108 \text{ kN}}$ (T)

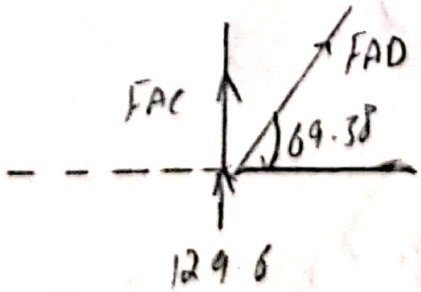
$\Sigma F_y = 0 \uparrow \downarrow -$

$-F_{BD} \cos 69.38^\circ + 159.6 = 0$

$0.35 F_{BD} = 159.6$

$\boxed{F_{BD} = 456 \text{ N}}$ (T)

Joint A



$\Sigma F_x = 0 \rightarrow + \leftarrow$

$-108 + F_{AD} \sin 69.38^\circ = 0$

$0.94 F_{AD} = 108$

$\boxed{F_{AD} = 114.9}$ (T)

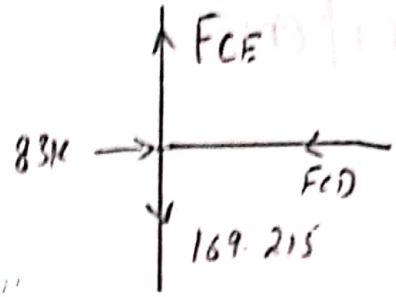
$\Sigma F_y = 0 \uparrow + \downarrow -$

$129.6 + F_{AC} + F_{AD} \cos 69.38^\circ = 0$

$F_{AC} + 129 + 114.9\,(0.35) = 0$

$$\boxed{F_{AC} = -169.215\ (C)}$$

Joint C:



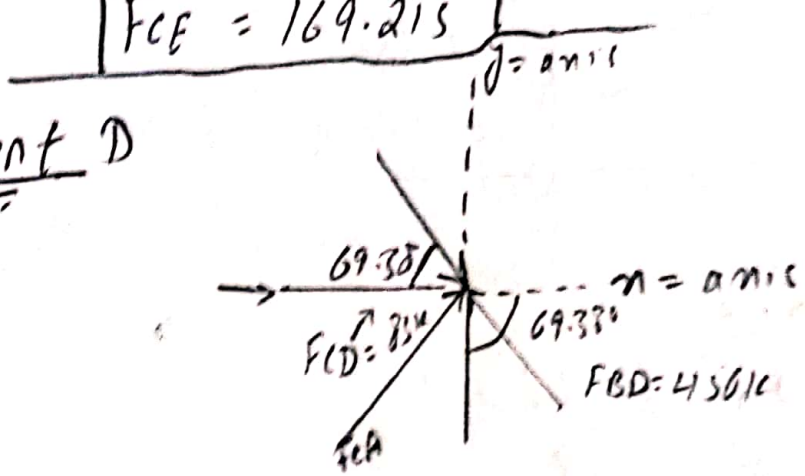
$\Sigma F_x = 0 \rightarrow + \leftarrow$

$$\boxed{F_{CD} = 83N}$$

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

$$\boxed{F_{CE} = 169.215}$$

Joint D



$\sum F_H = 0 \rightarrow +$

$83 + F_{DE} \sin 69.38 - [illegible] \cos 60.56 =$

$83 + F_{DE}(0.94) - 180.59 = 0$

$0.94 F_{DE} = 77.58$

$\boxed{F_{DE} = 82.54}$

$\sum F_V = 0 \quad + \downarrow -$

$4\%6 \sin 69.38^\circ - F_{DE} \cos 69.38^\circ = 0$