

MID TERM PAPER

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SUBMITTED BY:- 7835

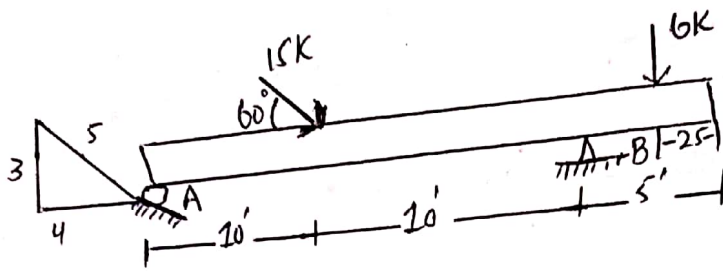
SUBMITTED TO:- Engr. Muhammad Saqib

SEMESTER :- 6th

SECTION :- B

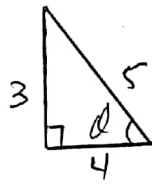
SUBJECT :- Structure Analysis 1

QNO 2:-



Sol:-

First of all we have to find the angle for the roller support



using trigonometry

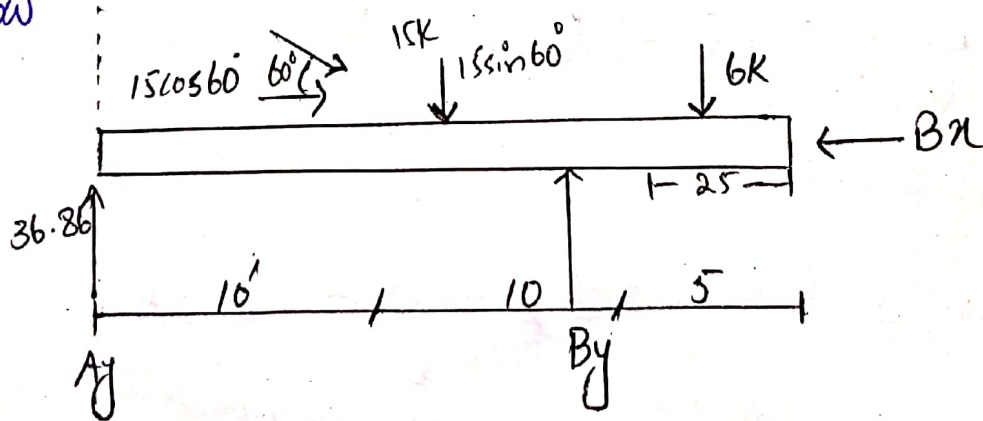
$$\sin \theta = P/H$$

$$\sin \theta = 3/5$$

$$\theta = \sin^{-1}(3/5)$$

$$\theta = 36.86^\circ$$

So now



$$1. \quad \sum F_x = 0 \quad \rightarrow \leftarrow$$

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

$$7.5 - B_x - 0.599 A_y = 0 \quad \text{--- (1)}$$

$$\begin{aligned} 2. \quad \Sigma F_y &= 0 \quad \uparrow + \downarrow - \\ A_y \cos 36.86^\circ + B_y - 6k - 15 \sin 60^\circ &= 0 \\ 0.80 A_y + B_y - 18.99 &= 0 \\ 0.80 A_y + B_y &= 18.99 \quad \text{--- (2)} \end{aligned}$$

$$\begin{aligned} 3. \quad \Sigma M_B &= 0 \quad \curvearrowright + \curvearrowleft - \\ (A_y \cos 36.86^\circ \times 20) - (15 \sin 60^\circ \times 10) + 6 \times 2.5 &= 0 \\ 16 A_y - 190 + 15 &= 0 \\ 16 A_y - 175 &= 0 \\ A_y &= 175/16 \\ A_y &= 10.9375 k \end{aligned}$$

put the values in eq (2)

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

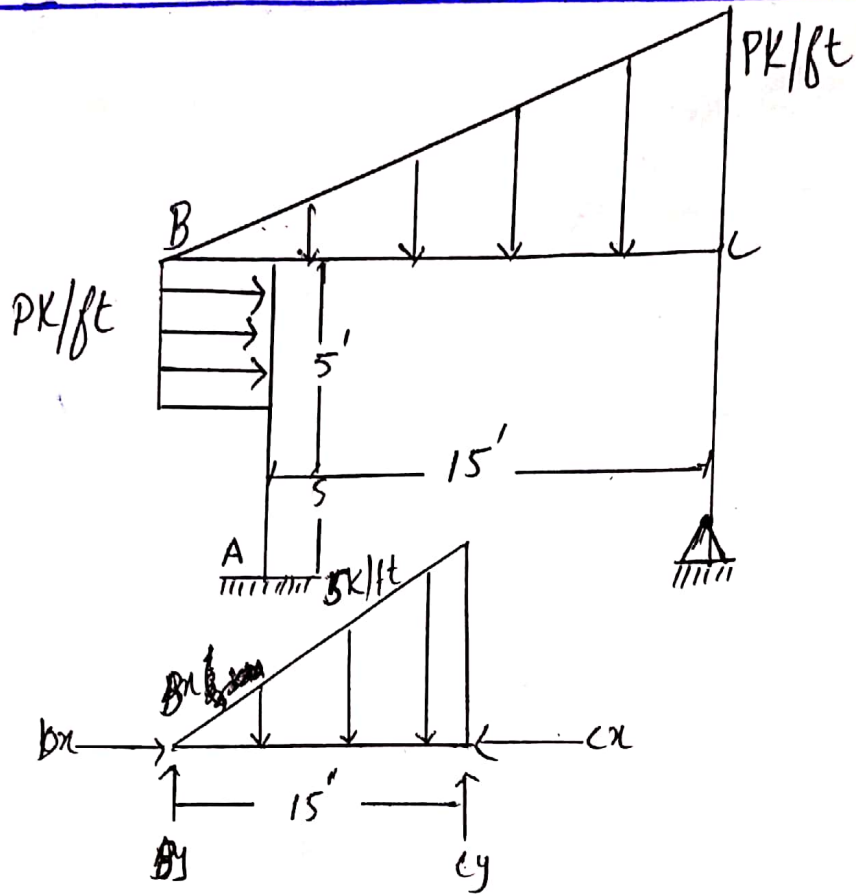
$$8.75 + B_y = 18.99$$

$$B_y = 18.99 - 8.75 \Rightarrow B_y = 10.25 k$$

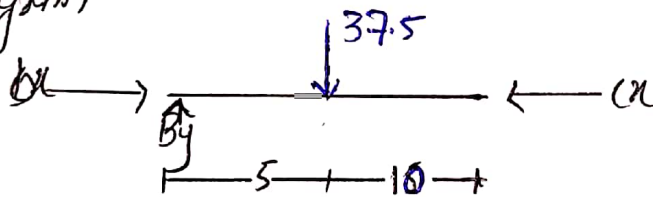
put in eq (1) value of A_y

$$7.5 - B_x - 0.599 (10.9375) = 0 \Rightarrow B_x = 0.9375 k$$

Q. NO. 2:-



F. B. Diagram



$$\text{Area} = \frac{1}{2} (15 \times 5)$$

$$= 37.5$$

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

$$i) \quad \sum F_x = 0 \quad \rightarrow + \leftarrow -$$

$$B_x - C_x = 0 \quad \text{--- (1)}$$

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

$$B_y + C_y = 37.5 \text{ k} \quad \text{--- (2)}$$

iii) $\sum M_B = 0 \downarrow + \uparrow -$

$$(37.5)(5) - C_y \times 15 = 0$$

$$187.5 = 15C_y$$

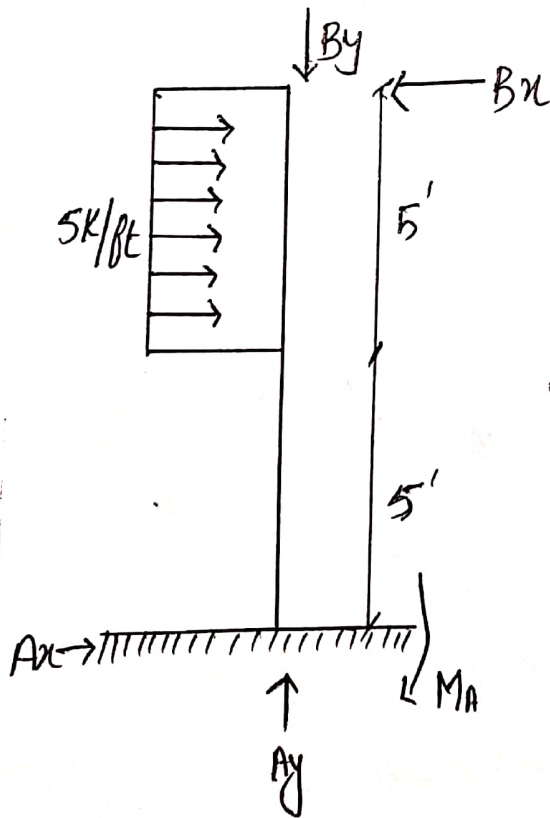
$$C_y = 12.5$$

put the value in eq (2)

$$B_y + 12.5 = 37.5$$

$$B_y = 37.5 - 12.5$$

$$B_y = 25K$$



i) $\sum F_x = 0 \rightarrow + \leftarrow -$

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

$$Ax - Bx = -25 \quad \text{--- (3)}$$

$$\text{ii) } \sum F_y = 0 \uparrow + \downarrow -$$

$$Ay - By = 0 \rightarrow \text{(4)}$$

$$\text{iii) } \sum M_A = 0 \downarrow + \uparrow -$$

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

$$25 \times 7.5 - Bx \times 10 = 0$$

$$187.5 = Bx \times 10$$

$$Bx = 18.75 \text{ k}$$

put in eq (3)

$$Ax - 18.75 = -25$$

$$Ax = -6.25 \text{ k}$$

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

$$Cy = ~~12.5~~ 12.5 \text{ k}$$

$$\text{so } Dy = -~~12.5~~ -12.5 \text{ k}$$

put the value of By in eq (4)

$$Ay - 25 = 0$$

⊙ $A_y = 25K$

put the value of B_x in equ (1)

$18.75 - C_x = 0$

$C_x = 18.75K$

lies on same plane

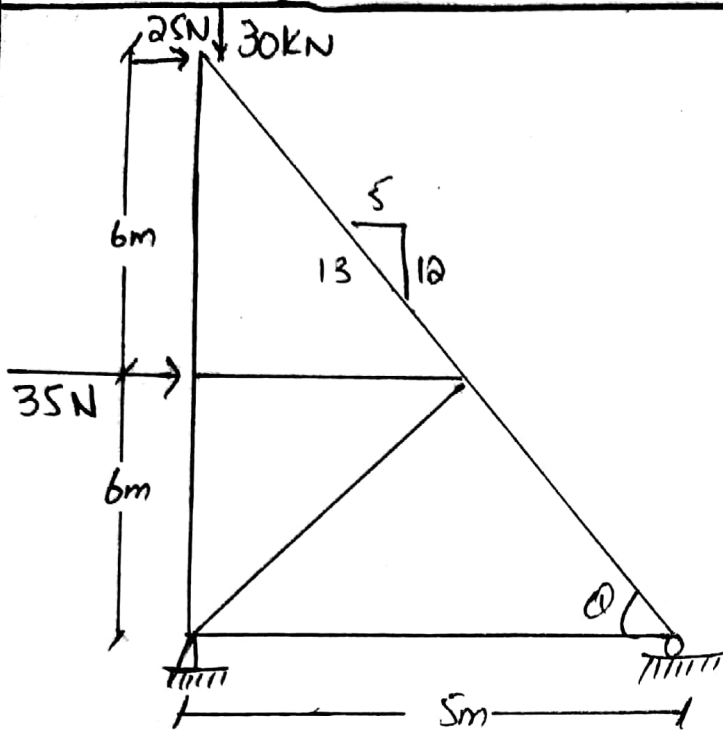
so $D_x = -18.75K$

$M_B = 0$

$-(5 \times 5)(2.5) - (A_x \times 10) + M_A = 0$

$-62.5 - (-6.25 \times 10) + M_A = 0$

$M_A = 0$



$$\sin \theta = P/h$$

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

$$\theta = 22.62$$

Sol: - $\sum M_A = 0$ $\curvearrowright +$

$$(25 \times 12) - (B_y \times 5) + (35 \times 6) = 0$$

$$300 + 210 = 5B_y$$

$$B_y = 102 \text{ k}$$

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

$$A_y + B_y - 30 = 0$$

$$A_y + 102 - 30 = 0$$

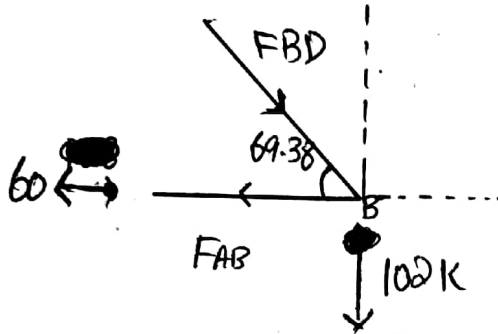
$$A_y = -72$$

$$\text{iii) } \Sigma F_x = 0 \quad \rightarrow + \leftarrow -$$

$$25 + 35 + Ax = 0$$

$$Ax = -60$$

joint B:-



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

$$-60 + F_{AB} = 0$$

$$F_{AB} = +60$$

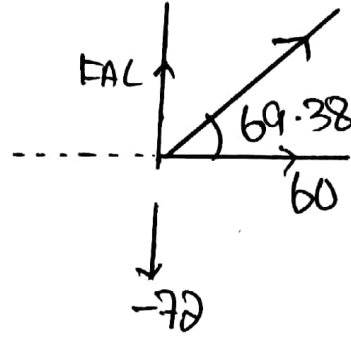
$$\Sigma F_y = 0 \quad \uparrow + \downarrow -$$

$$-F_{BD} \cos 69.38^\circ + 102 = 0$$

$$0.35 F_{BD} = -102$$

$$F_{BD} = -291.42$$

Joint A:-



$$\sum F_x = 0 \rightarrow + \leftarrow -$$

$$= +60 + F_{AD} \sin 69.38^\circ = 0$$

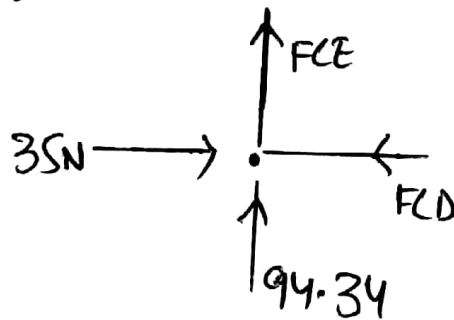
$$F_{AD} = -68.83 \text{ N}$$

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

$$= -72 + F_{AL} - F_{AD} \cos 69.38^\circ = 0$$

$$F_{AL} = 94.34 \text{ N}$$

Joint C:-



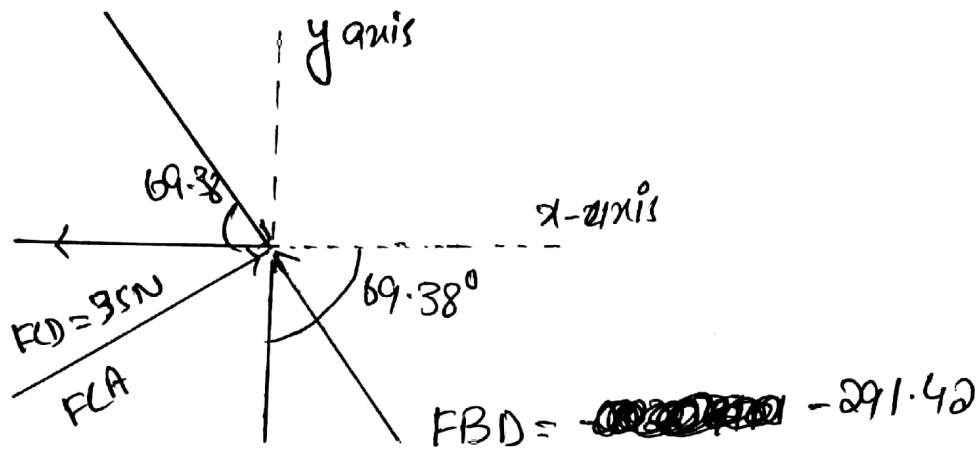
$$\sum F_x = 0 \rightarrow + \leftarrow -$$

$$F_{CD} = 35 \text{ N}$$

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

$$F_{CE} = -94.34 \text{ N}$$

Joint D: -



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

$$= -35 + F_{DE} \sin 69.38^\circ - 291.42 \cos 69.38^\circ = 0$$

$$F_{DE} = 145.75 \text{ N}$$