Mid Term Examination

Paper : Structural Analysis - I

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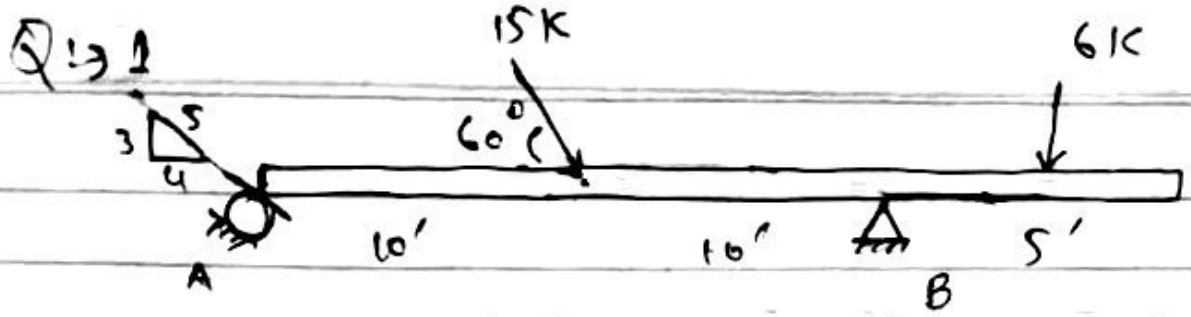
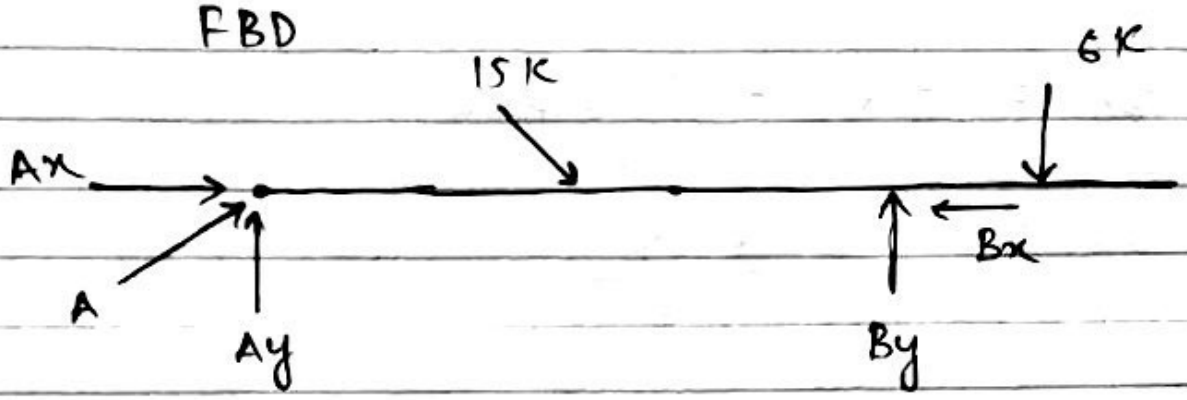
Q:) 1



FBD



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

$\Rightarrow \quad 15 \times \sin 60^\circ \times 10 + 6 \times 22.5 = By \times 20$

$\Rightarrow \quad \boxed{By = 13.245 \text{ K}}$

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

$\Rightarrow \quad Ay + By = 15 \sin 60^\circ + 6K$

$\Rightarrow \quad \frac{3}{5} A + 13.245 = 13 + 6$

$\Rightarrow \quad \boxed{A = 9.575 \text{ K}}$

Now $\quad Ax = 9.575 \times \frac{4}{5}$

$\Rightarrow \quad \boxed{Ax = 7.66 \text{ K}}$

$\Sigma F_x = 0 \longrightarrow +$

$\Rightarrow A_x + 15\cos 60 - B_x = 0$

$\Rightarrow B_x = 7.66 + 15\cos 60^\circ$

$\Rightarrow \boxed{B_x = 15.16\ K}$

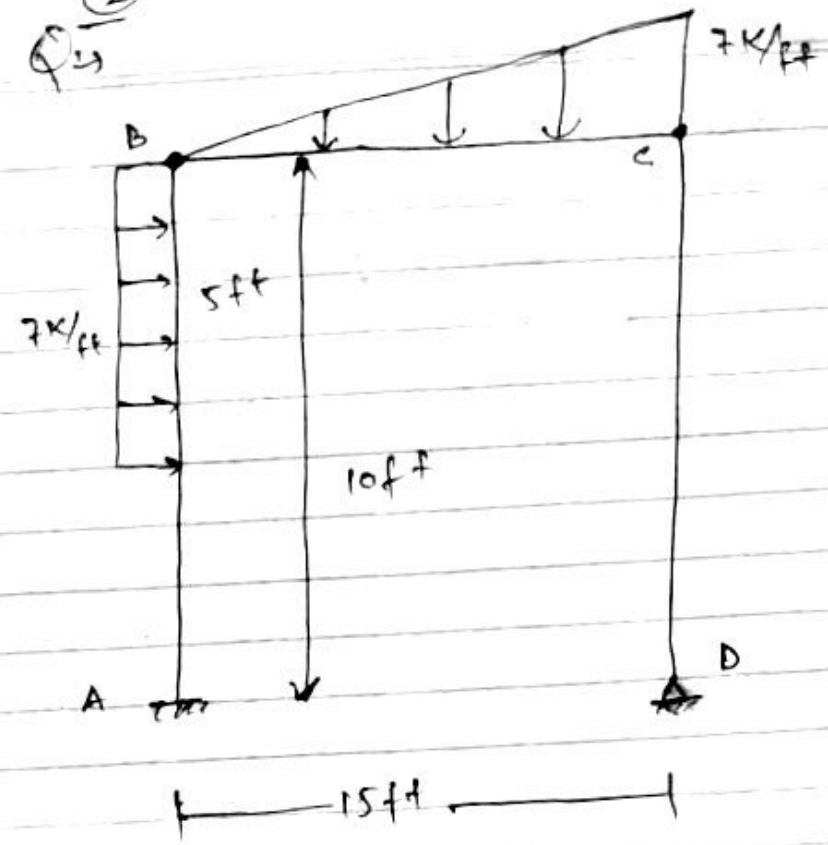
So support reactions are

[redacted]

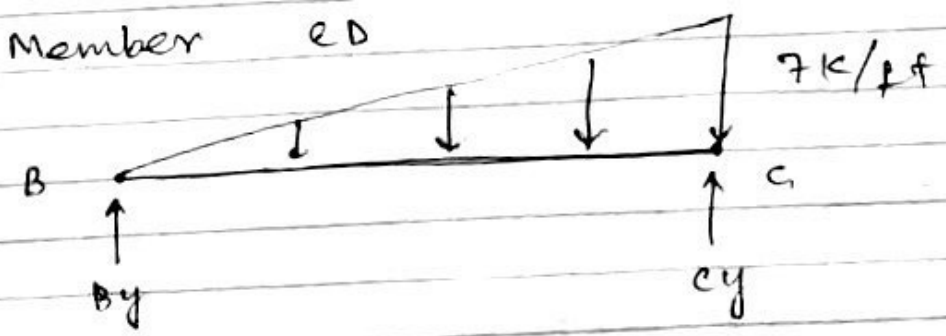
$\boxed{A = 9.575\ K}$

$\boxed{B_x = 15.16\ K}$

$\boxed{B_y = 13.245\ K}$



Member CD



$\Sigma M_B = 0 \quad \curvearrowright +$

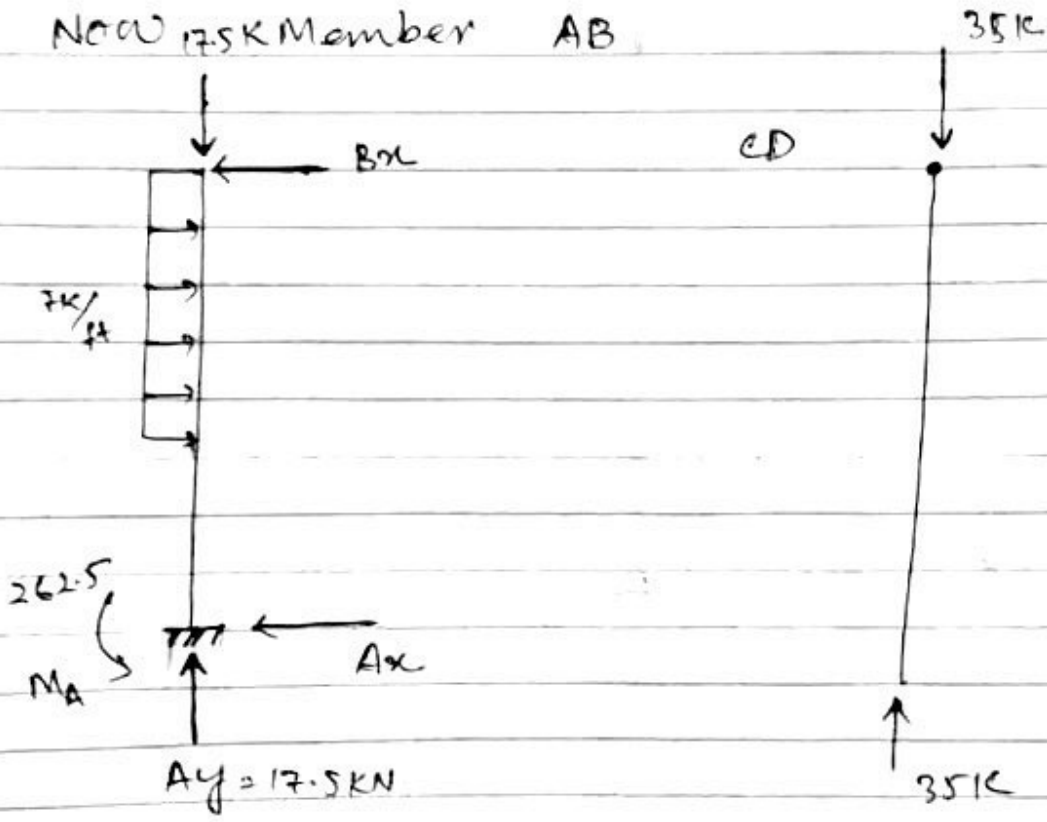
$\Rightarrow \frac{1}{2} \times 15 \times 7 \times \frac{2}{3} \times 15 = Cy \times 15$

$\Rightarrow \quad Cy = 35 \text{ K}$

$\Sigma F_y = 0$

$\Rightarrow \quad By + Cy = \frac{1}{2} \times 15 \times 7$

$\Rightarrow \quad By = 52.5 - 35 \Rightarrow \boxed{By = 17.5 \text{ K}}$



For whole structure

$\Sigma M_A = 0$ ↻

$\Rightarrow -M_A + 7\times5\times7.5 + \frac{1}{2}\times7\times15\times\frac{2}{3}\times15 - 35\times15 = 0$

$\Rightarrow \boxed{M_A = 262.5}$ K-ft

NOW in Member AB

~~$\Sigma M_A = 0$ ↻+~~

~~$-262.5 + 7\times5\times7.5 - B_x\times10 = 0$~~

$\rightarrow$ ~~B_x~~

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

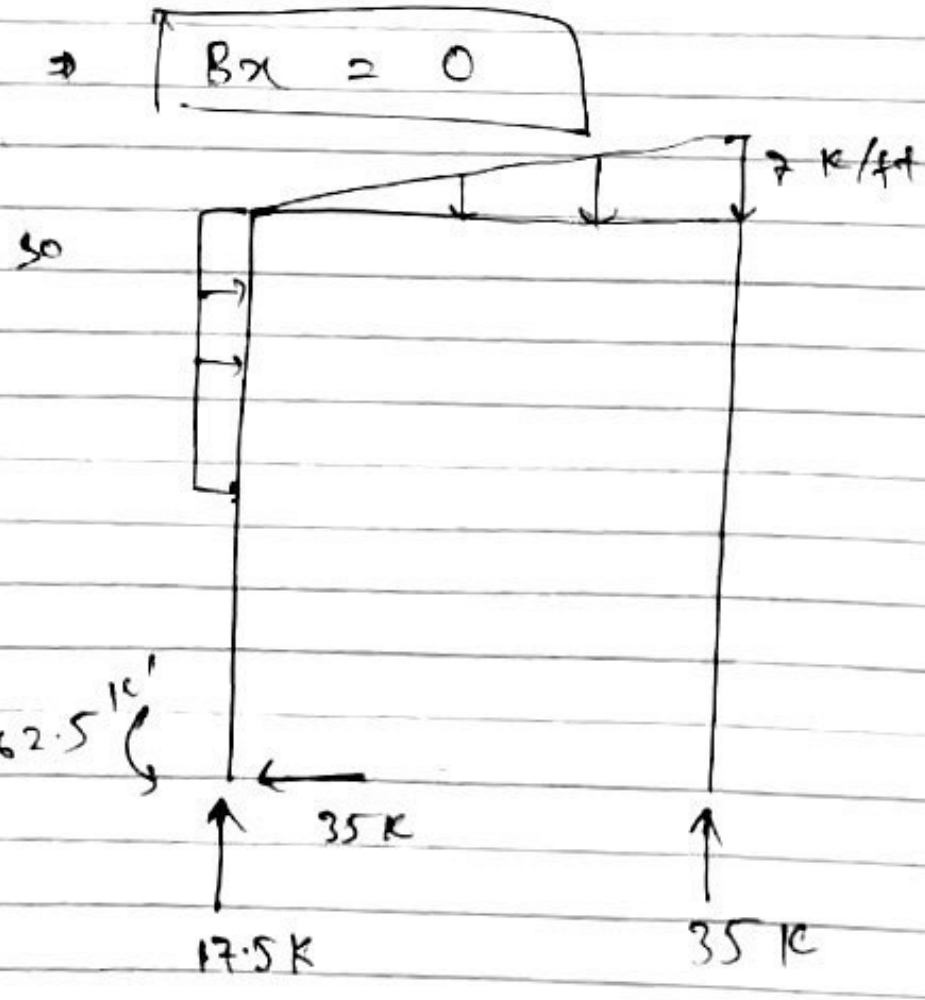
$7 \times 5 \times 2.5 + 262.5 = A_x \times 10$

$\Rightarrow \boxed{A_x = 35 \text{ K}}$

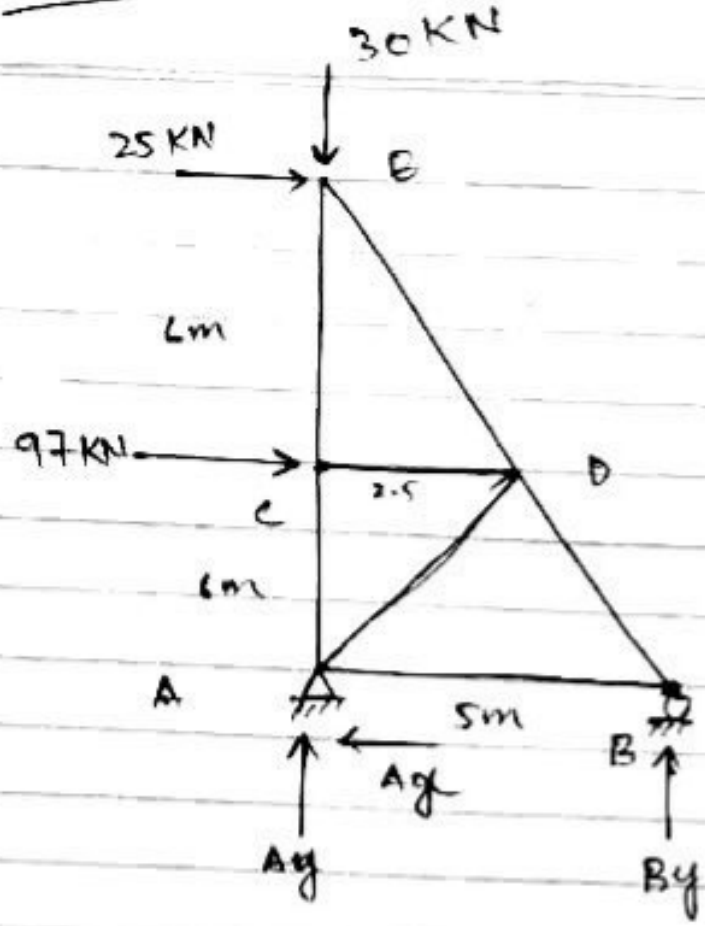
$\Sigma F_x = 0$

$\Rightarrow A_x + B_x = 35$

$\Rightarrow \boxed{B_x = 0}$



Q ⇒ (3)



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

$\Rightarrow \quad 25 \times 12 + 97 \times 6 = By \times 5$

$\Rightarrow \quad By = 176.4 \text{ KN}$

Now $\quad Ay + By = 30$

$\Rightarrow \quad Ay = 30 - 176.4$

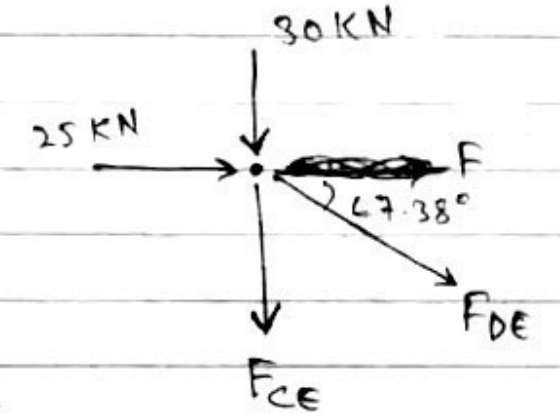
-146.4

$Ay =$ (Means Downward)

$Ax = 25 + 97$

$\boxed{Ax = 122 \text{ KN}}$

Joint E :⇒



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

$\Rightarrow 25 + F_{DE} \cos 67.38$

$\Rightarrow F_{DE} = \frac{-25}{\cos 67.38}$

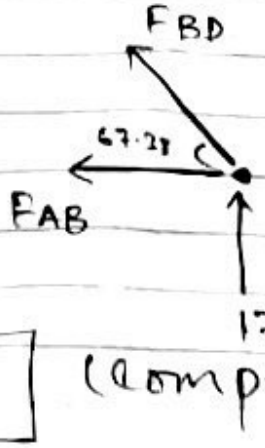
$\boxed{F_{DE} = -65 \text{ KN}}$ (Compression)

$\Sigma F_y = 0 \quad \uparrow$

$\Rightarrow -30 - F_{CE} + 65 \sin 67.38$

$\Rightarrow \boxed{F_{CE} = 30 \text{ KN}}$ (Tension)

NOW Joint B



$\Sigma F_y = 0 \quad \uparrow$

$\Rightarrow F_{BD} \sin 67.38 = -176.4$

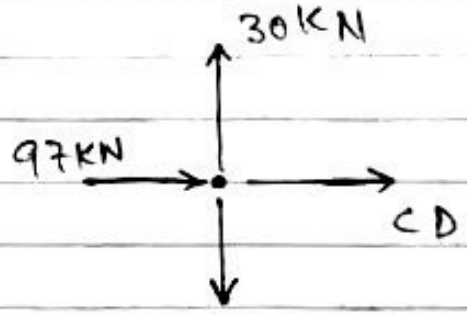
$\Rightarrow \boxed{F_{BD} = -191.1 \text{ KN}}$ (Compression)

$\Sigma F_x = 0 \quad \longrightarrow +$

$\Rightarrow -F_{AB} + 191.1 \times \cos 67.38 = 0$

$\Rightarrow \boxed{F_{AB} = 73.5 \text{ KN}}$ (Tension)

Now Joint C



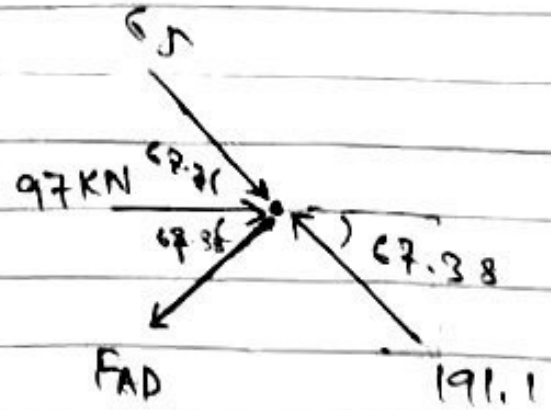
$\Rightarrow \Sigma F_x = 0$

$\Rightarrow \boxed{F_{CD} = -97 \text{ KN}}$ (Compression)

$\Sigma F_y = 0$

$\boxed{F_{AC} = 30 \text{ KN}}$ (Tension)

Now Joint D



$\Sigma F_y = 0 \uparrow$

$\Rightarrow 191.1 \times \sin 67.38 = 65 + F_{AD} \sin 67.38$

$\Rightarrow \boxed{F_{AD} = 126.1 \text{ KN}}$ (Tension)

Member	Force (KN)	Nature
AB	73.5	Tension
AD	126.1	Tension
BD	191.1	compression
CD	97	compression
CE	30	T [illegible]
DE	65	compression