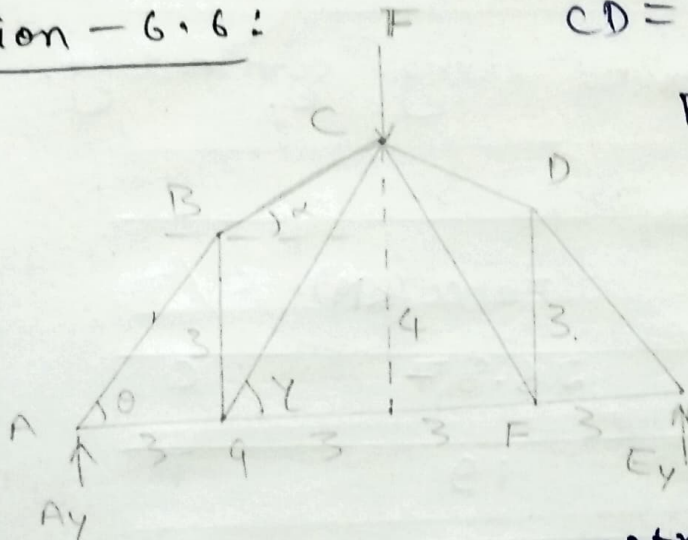


Siddhant

ME-102: Assignment: 3Question - 6.6:

$$CD = \sqrt{1^2 + 3^2} = \sqrt{10}$$

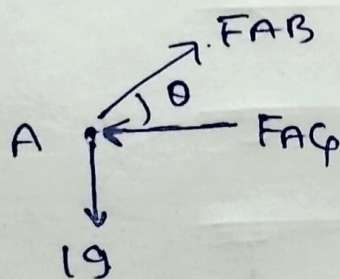
$$F = 2 \times 6 \times \sqrt{10}$$

$$F \approx 38 \text{ kN}$$

$$\tan \theta = 1$$

$$\tan \alpha = \frac{1}{3}, \tan \gamma = \frac{4}{3}$$

$$A_y = E_y = 19 \text{ kN (Symmetry)}$$

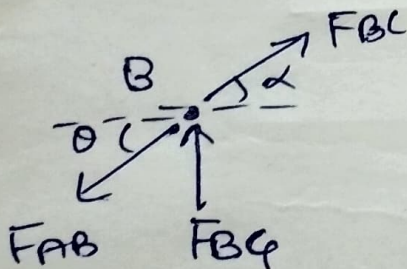


$$F_{AQ} = \frac{F_{AB}}{\sqrt{2}} = 19$$

$$F_{AQ} = 19, F_{AB} = 26.87$$

$$F_{BC} \cos \alpha = F_{AB} \cos \theta$$

$$F_{BC} \times \frac{3}{\sqrt{10}} = 19 \Rightarrow F_{BC} \approx 20$$



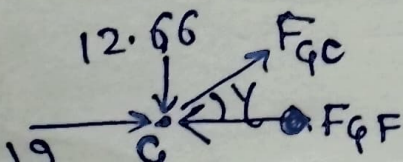
$$F_{BC} \sin \alpha + F_{BQ} = F_{AB} \sin \theta$$

$$\frac{19\sqrt{10}}{3} \times \frac{1}{\sqrt{10}} + F_{BQ} = 19$$

$$\Rightarrow F_{BQ} = \frac{38}{3} = 12.66$$

$$F_{CQ} \sin \gamma = 12.66$$

$$\Rightarrow F_{CQ} \times \frac{4}{5} = 12.66$$



$$F_{Gc} = 15.83 \text{ KN}$$

Siddhant

$$F_{GF} = F_{Gc} \cos \gamma + 19 = 15.83 \times \frac{3}{5} + 19$$

$$F_{GF} = 28.5 \text{ KN}$$

Rest forces can be found using symmetry.

Force Edge 1	Edge 2	Force (KN)	C/T
AB	DE	26.87	C
AG	FE	19	T
BG	DF	12.66	T
BC	DC	20	C
GC	FC	15.83	C
	GF	28.5	T

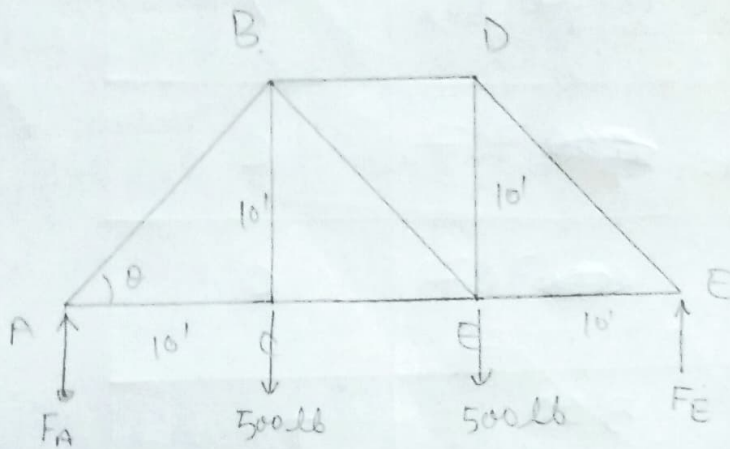
Question: 6.8

Siddhant

Replace the curve CE with a straight line.

$$\tan \theta = 1$$

$$\theta = 45^\circ$$



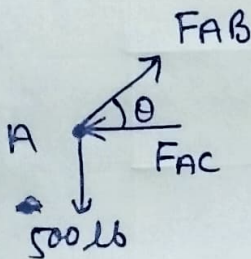
~~$$F_A = F_E = 500 \text{ lb}$$~~

$$\sum \tau_A = 0 \Rightarrow 500 \times 10 + 500 \times 20 = F_E \times 30$$

~~$$\Rightarrow F_E = 500 \text{ lb}$$~~

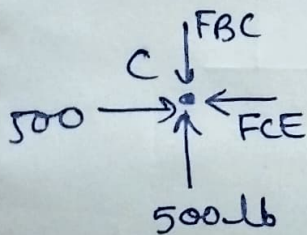
Similarly, $F_A = 500 \text{ lb}$

$$F_{AC} = \frac{F_{AB}}{\sqrt{2}} = 500$$



$$\Rightarrow F_{AC} = 500, F_{AB} = 500\sqrt{2} = 707$$

$$F_{BC} = 500, F_{CE} = 500$$



$$F_{AB} \sin \theta + F_{BE} \sin \theta = 500$$

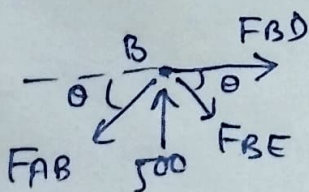
$$\Rightarrow F_{BE} \sin \theta = 500 - 500 = 0$$

$$\Rightarrow F_{BE} = 0$$

$$F_{AB} \cos \theta = F_{BD} + F_{BE} \cos \theta$$

$$\Rightarrow 500 = F_{BD} + 0$$

$$F_{BD} = 500$$



$$F_{BC} = 0$$

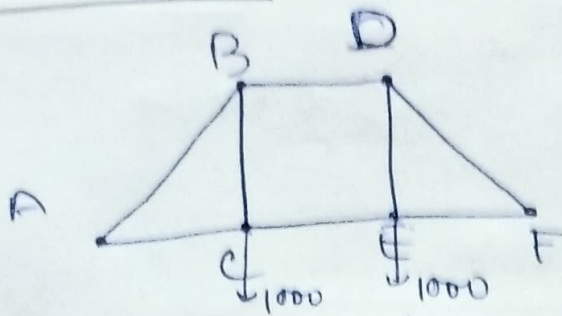
Siddhant

So, the two halves are similar.

Edge	Force (lb)	C/T
AB	400 707	C
DF	500 707	C
AC	500	T
FE	500	T
CE	500	undefined
BE	0	—
BC	500	T
DE	500	T
BD	500	C

Question 6.10

Siddhant



Find w_{eq} at each point -

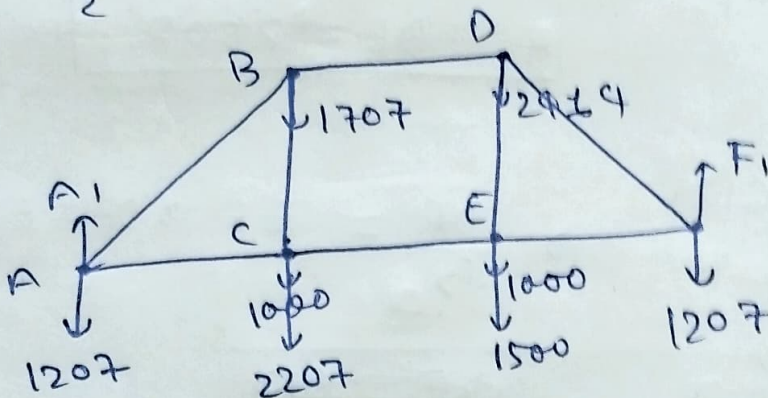
$$w_A = w_F = \frac{1}{2} \times 10 \times 100 + \frac{1}{2} \times 10\sqrt{2} \times 100 = 1207$$

$$w_E = 3 \times \frac{1}{2} \times 10 \times 100 = 1500$$

$$w_B = 2 \times \frac{1}{2} \times 10 \times 100 + \frac{1}{2} \times 10\sqrt{2} \times 100 = 1707$$

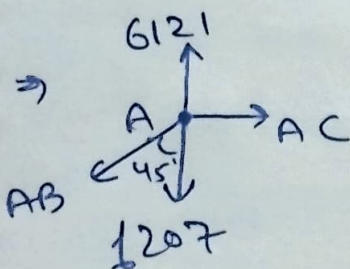
$$w_C = 3 \times \frac{1}{2} \times 10 \times 100 + \frac{1}{2} \times 10\sqrt{2} \times 100 = 2207$$

$$w_D = 2 \times \frac{1}{2} \times 10 \times 100 + 2 \times \frac{1}{2} \times 10\sqrt{2} \times 100 = 2914$$



$$w_{net} = \sum w_i + 1000 + 1000 = 12242$$

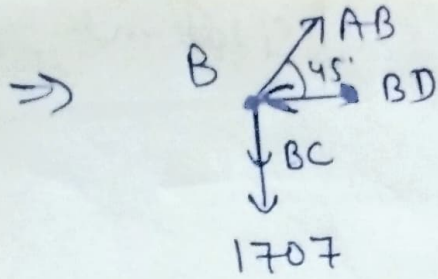
$$\Rightarrow A_1 = F_1 = 6121$$



$$\Rightarrow \frac{AB}{\sqrt{2}} = 6121 - 1207 = 4914$$

$$\text{and } AC = AB/\sqrt{2}$$

$$\Rightarrow \boxed{AB = 6950, AC = 4914}$$



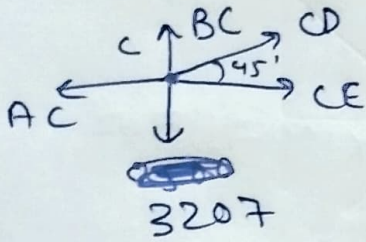
$$\frac{AB}{\sqrt{2}} = BD \Rightarrow \boxed{BD = 4914}$$

$$\frac{AB}{\sqrt{2}} = BC + 1707$$

$$\Rightarrow 4914 = BC + 1707$$

$$\Rightarrow \boxed{BC = 3207}$$

⇒

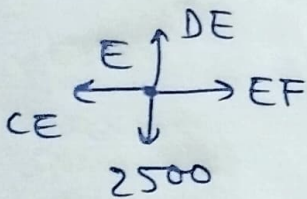


$$\frac{CD}{\sqrt{2}} + BC = 3207$$

$$\Rightarrow \boxed{CD = 0}$$

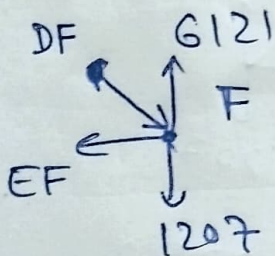
$$\frac{CD}{\sqrt{2}} + CE = AC \Rightarrow \boxed{CE = 4914}$$

⇒



⇒

$$\boxed{EF = 4914 \text{ and } DE = 2500}$$



$$\Rightarrow \frac{DF}{\sqrt{2}} = EF \Rightarrow DF = EF\sqrt{2}$$

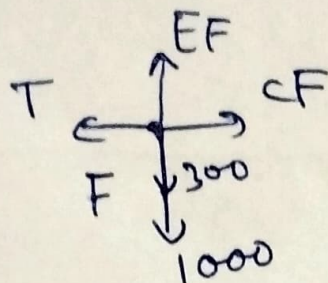
~~$$DF = 6950$$~~

$$\boxed{DF = 6950}$$

question - 6.11

$T = 1000 \text{ N}$

Siddhant



$\Rightarrow CF = 1000 \text{ and } EF = 1300$

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

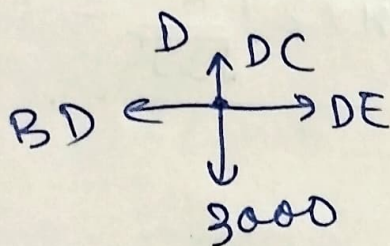
$CE \sin \theta = EF + 800$

$CE \cdot \frac{3}{\sqrt{34}} = 1300 + 800$

$CE = \frac{\sqrt{34}}{3} \times 2100 = 4081.67$

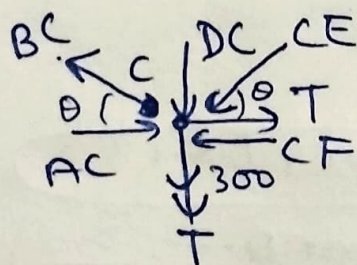
$DE = CE \cos \theta = \frac{\sqrt{34}}{3} \times 2100 \times \frac{5}{\sqrt{34}}$

$\Rightarrow CE = 4081.67 \text{ and } DE = 3500$



$BD = DE \text{ and } DC = 3000$

$\Rightarrow BD = 3500 \text{ and } DC = 3000$

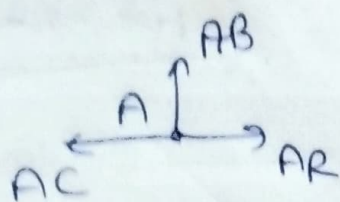


$300 + CE \sin \theta + DC + T = BC \sin \theta$

$300 + 700 \frac{\sqrt{34}}{\sqrt{34}} \cdot \frac{3}{\sqrt{34}} + 3000 + 1000 = BC \cdot \frac{3}{\sqrt{34}}$

$\frac{3}{\sqrt{34}} BC = 6100 + 300 = 6400$

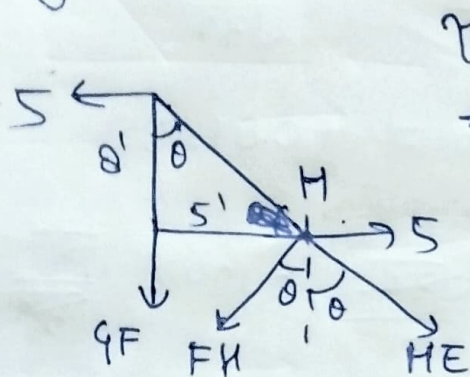
$AC = BC \cos \theta + CE \cos \theta \Rightarrow BC = 12439.36 \text{ and } AC = 14166.6$



$$\Rightarrow \boxed{AB = 0} \quad \text{Siddhant}$$

Question - 6.32

→ cutting section through GF, HF, HE:-



$$\sum \tau_H = 0$$

$$\Rightarrow 5 \times 8 = -GF \times 5$$

$$GF = 8 - 8$$

$$\tan \theta = \frac{5}{8}$$

$$FH \sin \theta = HE \sin \theta \Rightarrow FH = HE$$

$$FH \cos \theta + HE \cos \theta + GF = 0$$

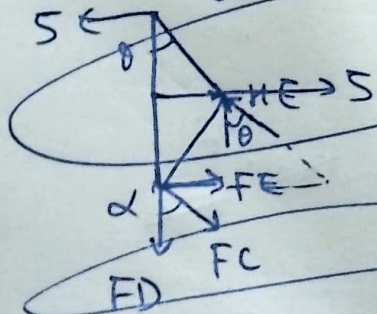
$$\Rightarrow 2FH \cos \theta = -GF \Rightarrow FH \times 2 \times \frac{8}{\sqrt{89}} = +8$$

$$\Rightarrow FH = HE = +\frac{\sqrt{89}}{2}$$

$$\Rightarrow \boxed{FH = HE = 4.72 \text{ K T}}$$

→ cutting section through FD, FC, FE, HE

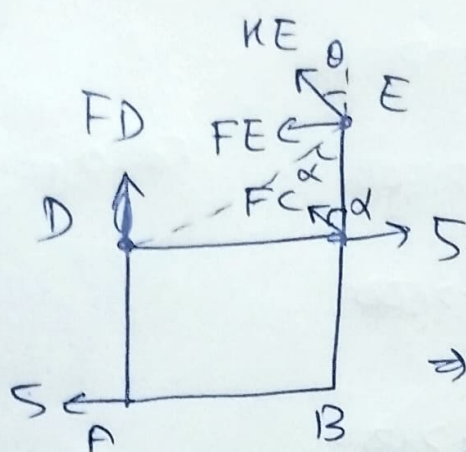
$$\tan \alpha = \frac{10}{8}, \quad \tan \theta = \frac{5}{8}$$



$$HE \cos \theta = FD + FC \cos \alpha$$

$$HE \sin \theta = FC \sin \alpha + FE$$

→ Cutting through FD, FC, FE, KE | Siddhant



$$\tan \theta = \frac{5}{8}, \quad \tan \alpha = \frac{10}{8}$$

$$\sum F_x = 0$$

$$b \sin \alpha + a + KE \sin \theta = 0$$

$$\Rightarrow b \sin \alpha + a + \frac{5}{2} = 0$$

$$\Rightarrow 8b \sin \alpha + 8a + 20 = 0 \quad \text{--- (1)}$$

$$\tau_D = 0 \quad (\text{here } a = FE, b = FC)$$

$$\Rightarrow b \cdot 10 \cos \alpha + 8a - 5 \cdot 8 + KE \sqrt{164} \sin(\alpha + \theta) = 0$$

$$10b \cos \alpha + 8a = 40 - 60 = -20$$

$$8a + 20 = -10b \cos \alpha \quad \text{--- (11)}$$

From (1) and (11),

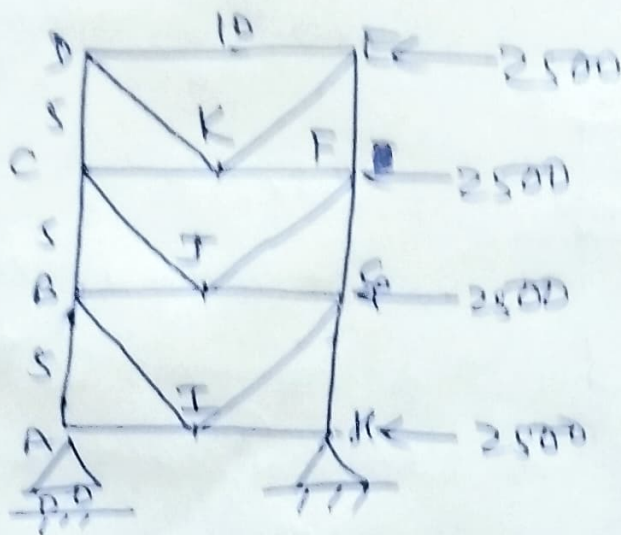
$$8b \sin \alpha = 10b \cos \alpha \Rightarrow b = 0$$

$$\Rightarrow \boxed{FC = 0}$$

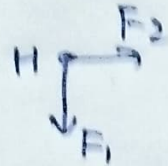
$$b \sin \alpha + a + \frac{5}{2} = 0 \quad \text{and } b = 0$$

$$\Rightarrow a = -\frac{5}{2} \Rightarrow$$

$$\boxed{FE = \frac{5}{2}}$$



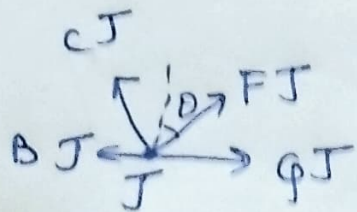
Force in FJ = ?



$$F_2 = 10000$$

$$\sum M = 0 \Rightarrow 10F_1 = 5 \cdot 2500 + 10 \cdot 2500 + 15 \cdot 2500$$

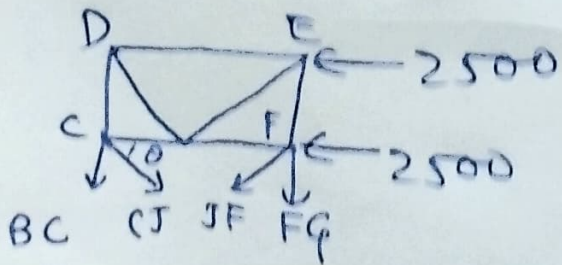
$$10F_1 = 30 \cdot 2500 \Rightarrow F_1 = 7500$$



$$F_J \cos 45^\circ = -C_J \cos 45^\circ$$

$$\Rightarrow F_J = -C_J \quad \text{--- (1)}$$

Consider section through BC, CJ, JF, FG.



$$\theta = 45^\circ$$

$$\theta \frac{C_J}{\sqrt{2}} - \frac{JF}{\sqrt{2}} - 5000 = 0$$

$$\Rightarrow \frac{C_J}{\sqrt{2}} + \frac{C_J}{\sqrt{2}} = 5000 \Rightarrow C_J = \frac{5000\sqrt{2}}{2} \quad \text{--- (1)}$$

$$\text{(1) and (1)} \Rightarrow F_J = 3535 \text{ N T}$$