

Tutorial - 5

CP FBD of Truss:-

$$\sum M_A = 0$$

$$-B_y \times 6 - 928 - 1300 = 0$$

$$B_y = 259.82 \text{ N}$$

$$\sin 30^\circ = \frac{3.464}{AB}$$

$$\therefore AB = 6.928 \text{ m}$$

$$\tan 30^\circ = \frac{EB}{6}$$

$$EB = 3.464 \text{ m}$$

Taking right of AB

$$\sum F_x = 0$$

$$F_{DE} - F_{AB} \cos 30^\circ + F_{AB} \cos 49.1^\circ = 259.82 \sin 30^\circ \quad \text{--- (1)}$$

$$\sum F_y = 0$$

$$259.82 \cos 30^\circ + F_{AB} \sin 30^\circ = F_{AB} \sin 49.1^\circ \quad \text{--- (2)}$$

$$\sum M_B = 0, -F_{DE} \times 3.464 - F_{AB} (\cos 49.1^\circ) \times 3.464 = 0$$

$$F_{DE} = -(\cos 49.1^\circ) F_{AB} \quad \text{--- (3)}$$

From (3) & (2)

$$F_{AB} (\cos 30^\circ) = 259.82 (\sin 30^\circ)$$

$$F_{AB} = 150 \text{ N}$$

From (2)

$$\therefore F_{AB} = \frac{259.82 \cos 30^\circ + 150 \times \sin 49.1^\circ}{\sin 49.1^\circ}$$

$$F_{AB} = 396.92 \text{ N}$$

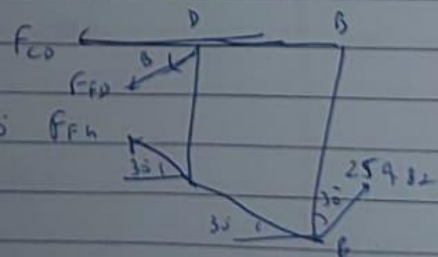
$$\text{From (3), } F_{DE} = (-\cos 49.1^\circ) (396.92) = -259.88 \text{ N}$$

Taking right of AD

$$\sum F_x = 0$$

$$F_{CD} + F_{DE} \cos 30^\circ + F_{AB} \cos 30^\circ = 259.82 \sin 30^\circ$$

By using



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$$\sum F_y > 0$$

$$F_{FB} \sin 30^\circ + 259.02 \cos 30^\circ = F_{FB} \sin 10^\circ \quad \text{--- (2)}$$

$$\angle M_1 = 0$$

$$F_{F_k}(\ln 30) \approx 1.15 - 259.02(\ln 30) \approx 2.70$$

$$F_{F_4} = 450 \text{ (ksi)} \times 1.155 = 449.08 \text{ N}$$

$$F_{FA} = 449.86 \sim$$

from (4), we get $F_{FD} = 449.88 \text{ (for } 30') + 259.82 \text{ (for } 30')$
 $\text{for } 30'$

$$299.90 \text{ N} \approx 900 \text{ N}$$

$$F_{gr} = 396.92 \text{ N}$$

$$F_{FD} = 900 \text{ N}$$

Tensile

Tarsile

(2) taking right of x, x'

$$\sum M_A = 0$$

$$F_{1,2}(\sin 33.69^\circ) \leq 3.76, 0$$

$$F_{ED} = 3.61 \text{ kN}$$

$$\sum F_r = 0$$

$$F_{AB} + F_{CD} \cos 33^\circ - 69 = 0$$

$$F_{AB} = F_{CD} \text{ (is } 33.19)$$

2 3.61 cos 33.69

$F_{AB} = 3 \text{ kN}$

$$4fy = 0$$

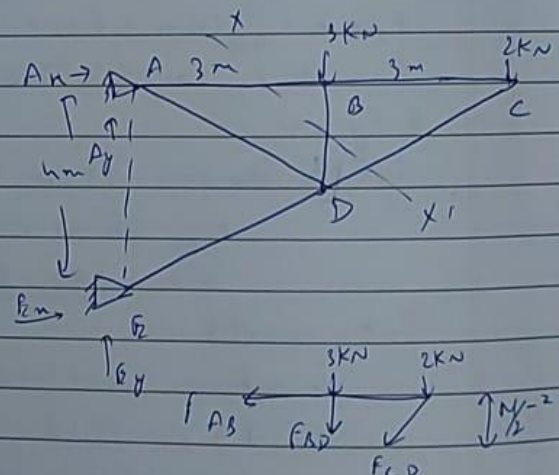
$$F_{B2} + F_{CD} \sin 33.69 + 5 = 0$$

$$F_{BD} = -3 \text{ kN}$$

$\therefore F_{CD} = 3.61 \text{ kN}$, compressive

$F_{AB} = 3 \text{ kN}$ Tension

$F_{AD} = 3 \text{ kN}$, compressive



$$T_{\text{an } 0} = \frac{4}{1} \Rightarrow 0.33.61$$

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(3) FBD of Truss :

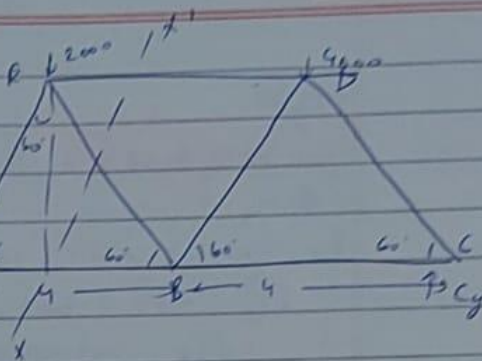
$$\sum M_A = 0;$$

$$2000 \times 2 + 4000 \times 6 = C_y \times 8$$

$$C_y = \frac{2000 \times 2 + 4000 \times 6}{8} = 3500 \text{ N}$$

$$A_x \rightarrow$$

$$A_y \uparrow$$



Taking Right section of X-X'

$$\sum M_D = 0$$

$$-F_{DB} \times 3.464 + 8000 = 13500 \times 4$$

$$F_{DB} = -1732.10 \text{ N}$$

$$\sum F_x = 0;$$

$$F_{AB} + F_{BD} \cos 60^\circ + F_{DE} = 0$$

$$F_{AB} + F_{BD} \cos 60^\circ + 1732.1 = 0 \quad \text{--- (1)}$$

$$\sum F_y = 0$$

$$F_{BD} \sin 60^\circ + 3500 = 4000$$

$$F_{BD} \sin 60^\circ = 500$$

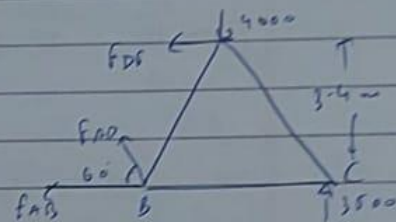
$$F_{BD} = 577.35 \text{ N}$$

Put in (1)

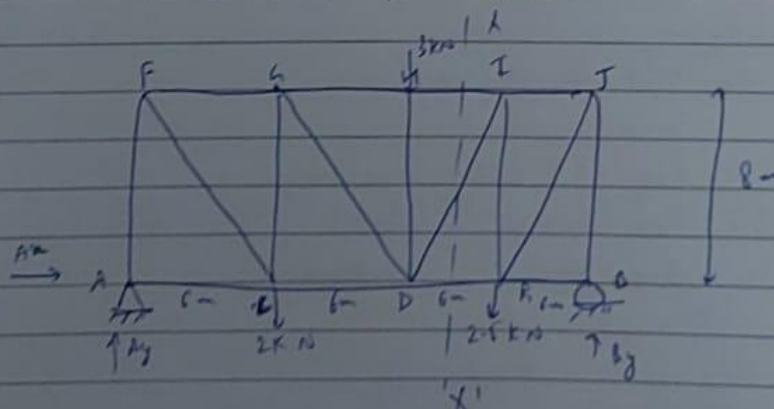
$$\therefore F_{AB} = 1443.42 \text{ N}$$

$$\therefore F_{DE} = 1732.1 \text{ N, Compression}$$

$$F_{BD} = 577.35 \text{ N, Tension}$$



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FBD of truss:

$\angle MA'OD'$

$$2 \times 6 + 2.5 \times 18 + 3 \times 12 = \text{By} \times 24$$

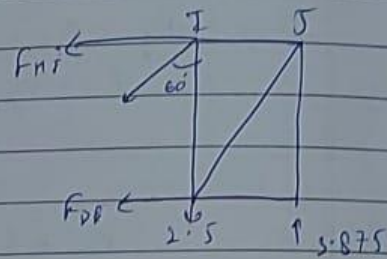
$R_y = 3.875 \text{ kN}$

FBD of right section of xx'

$$\sum M_c = 0$$

$$F_{DE} \times 8 = 3.875 \times 6$$

$$F_{DE} = 2.91 \text{ kN}$$



$$\tan C = \frac{6}{8}$$

$$\sum F_n \rightarrow 0$$

$$F_{MR} + F_{DR} \sin 36.87^\circ = -2.91 \quad \text{--- } \odot \quad \odot, 36.87^\circ$$

$$\sum F_y = 0$$

FDP Cos $36.87 + 2.5 = 39.375$

$$F_{DF} = 1.72 \text{ kN}$$

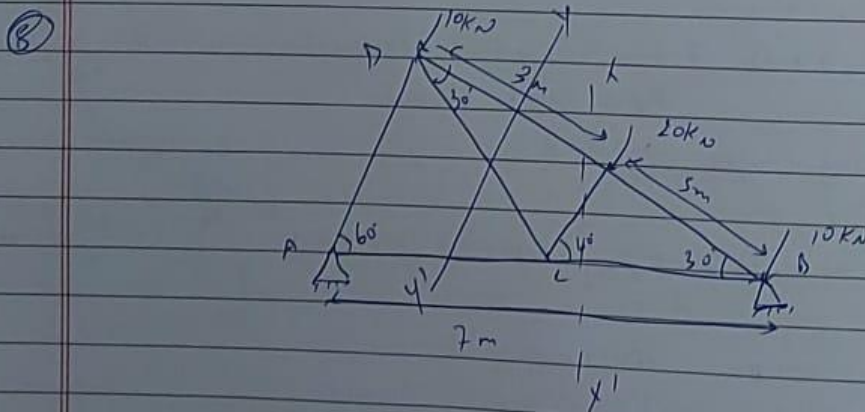
$$F_{\text{low}} \text{ ①, } F_{\text{HD}}' = (2.91 + F_{\text{DE}} \sin 36.87)$$

$F_{H1} = -3.94 \text{ KN}$

$\therefore F_{DB} = 2.91 \text{ KN}$, tensile

$F_{DF} = 1.72 \text{ kN}$, tensile

$F_{H1} = 3.94 \text{ kN}$, compressive

~~Spring~~

$$\sum F_x = 0;$$

$$B_x - 10 \cos 60^\circ - 20 \cos 60^\circ - 10 \cos 60^\circ = 0$$

$$B_x = 5 + 5 + 5 = 15 \text{ kN}$$

$$\sum F_y = 0;$$

$$R_A + B_y - 10 \sin 60^\circ - 20 \sin 60^\circ - 10 \sin 60^\circ = 0$$

$$R_A + B_y = 20\sqrt{3}$$

$$\sum M_B = 0$$

$$-7R_A + 10 \times 3 + 10 \times 6 = 0$$

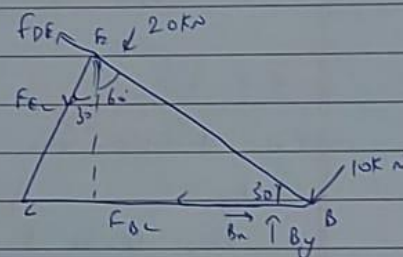
$$R_A = 17.1 \text{ kN}$$

FBD of right of x-x'

$$\sum M_B = 0$$

$$-60 - F_{BC} \times 3 = 0$$

$$F_{BC} = 20 \text{ kN (Compression)}$$



$$10 \times 3 + F_{BC} \times \frac{3}{2} - B_y \times \frac{3\sqrt{3}}{2} - B_x \times \frac{3}{2} = 0$$

$$60 + 3F_{BC} - 3\sqrt{3}(17.1) - 60 = 0$$

$$F_{BC} = 30.31 \text{ kN}$$

$$\sum M_C = 0$$

$$-F_{ED} \times \sqrt{3} - 17.1 \times 2\sqrt{3} + 10 \times 2\sqrt{3} \sin 60^\circ = 0$$

$$F_{ED} = -17.68 \text{ kN}$$

taking right of y-y'

$$\sum M_A = 0$$

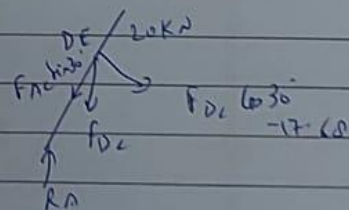
$$-17.68 \times \frac{7\sqrt{3}}{2} + F_{DC} (\cos 30^\circ) \times \frac{7\sqrt{3}}{2} = 0$$

$$F_{DC} = 20.42 \text{ kN}$$

$$\therefore F_{DC} = 20.42 \text{ kN, Tensile}$$

$$F_{BC} = 30.31 \text{ kN, Tensile}$$

$$F_{CB} = 20 \text{ kN, Compression}$$



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