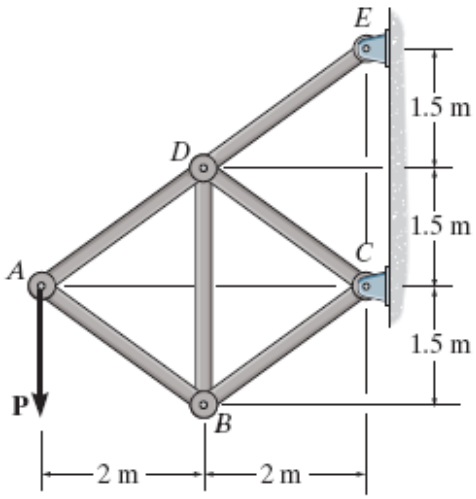
Problems # 5(Part I) -SOLUTION

Structural Analysis-"TRUSS"

6–16. Determine the force in each member of the truss, and state if the members are in tension or compression. P=5 kN ***(Using method of Joints)***



Method of Joints: We will begin by analyzing the equilibrium of joint *A*, and then proceed to analyzing that of joints *B* and *D*.

Joint *A*: From the free - body diagram in Fig. *a*,

$\Sigma F_{y'} = 0;\ F_{AD} \sin 73.74° - 5 \sin 53.13° = 0$

$F_{AD} = 4.167\,\text{kN} = 4.17\,\text{kN (T)}$ **Ans.**

$\Sigma F_{x'} = 0;\ 4.167 \cos 73.74° + 5 \cos 53.13° - F_{AB} = 0$

$F_{AB} = 4.167\,\text{kN} = 4.17\,\text{kN (C)}$ **Ans.**

Joint *B*: From the free - body diagram in Fig. *b*,

$\overset{+}{\rightarrow} \Sigma F_x = 0;\quad 4.167\left(\frac{4}{5}\right) - F_{BC}\left(\frac{4}{5}\right) = 0$

$F_{BC} = 4.167\,\text{kN} = 4.17\,\text{kN (C)}$ **Ans.**

$+\uparrow \Sigma F_y = 0;\quad F_{BD} - 4.167\left(\frac{3}{5}\right) - 4.167\left(\frac{3}{5}\right) = 0$

$F_{BD} = 5\,\text{kN (T)}$ **Ans.**

Joint *D*: From the free - body diagram in Fig. *c*,

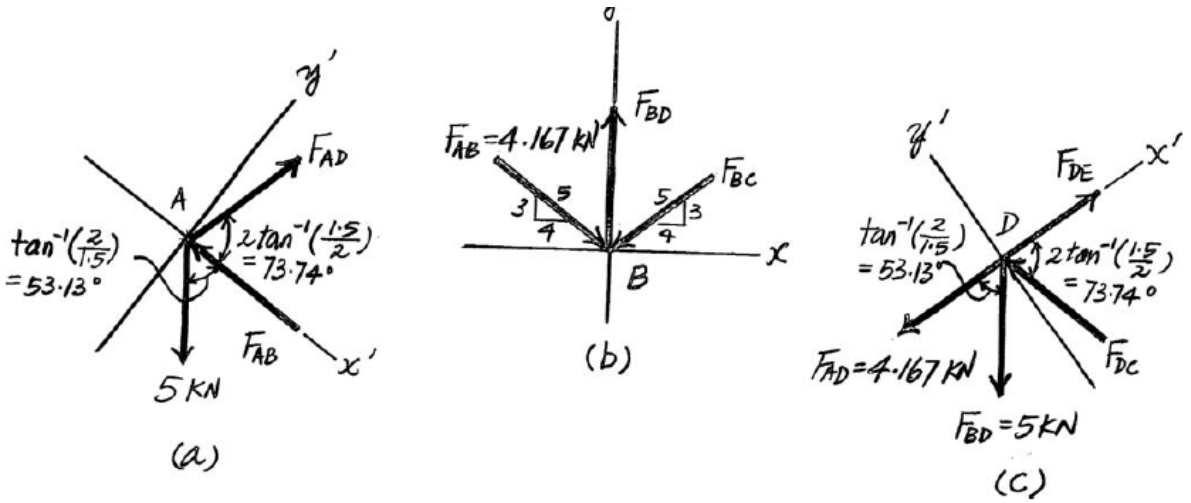
$+\nwarrow \Sigma F_{y'} = 0;\ F_{DC} \sin 73.74° - 5 \sin 53.13° = 0$

$F_{DC} = 4.167\,\text{kN} = 4.17\,\text{kN (C)}$ **Ans.**

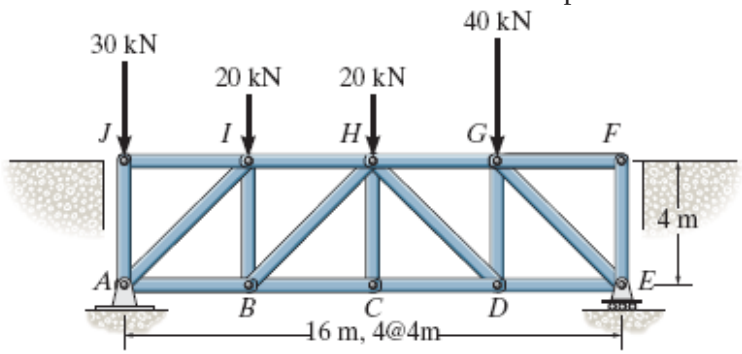
$+\nearrow \Sigma F_{x'} = 0;\ F_{DE} - 4.167 - 5 \cos 53.13° - 4.167 \cos 73.74° = 0$

$F_{DE} = 8.333\,\text{kN} = 8.33\,\text{kN (T)}$ **Ans.**

Note: The equilibrium analysis of joints *E* and *C* can be used to determine the components of the support reaction at supports *E* and *C*, respectively.



6–32. The Howe bridge truss is subjected to loading shown. Determine the force in members HD, CD, and GD, and state if the members are in tension or compression.



Support Reactions :

$$\zeta + \Sigma M_A = 0; \quad E_y(16) - 40(12) - 20(8) - 20(4) = 0$$
$$E_y = 45.0 \text{ kN}$$

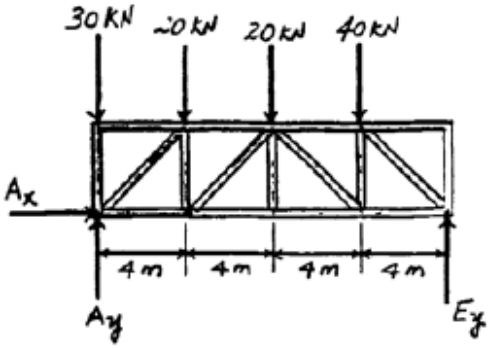
Method of Sections :

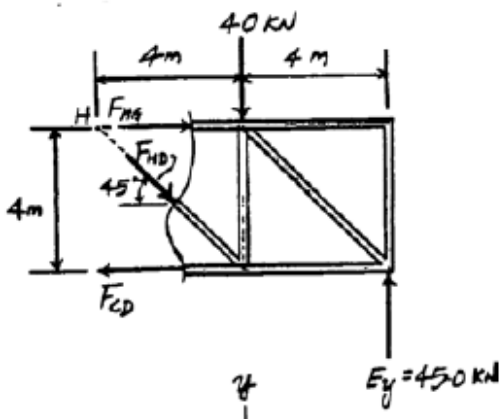
$$\zeta + \Sigma M_H = 0; \quad 45.0(8) - 40(4) - F_{CD}(4) = 0$$
$$F_{CD} = 50.0 \text{ kN (T)} \qquad \text{Ans}$$

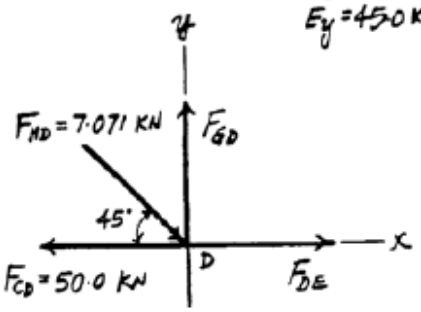
$$+\uparrow \Sigma F_y = 0; \quad 45.0 - 40 - F_{HD}\sin 45° = 0$$
$$F_{HD} = 7.071 \text{ kN (C)} = 7.07 \text{ kN (C)} \qquad \text{Ans}$$

Method of Joints : Analysing joint *D*, we have

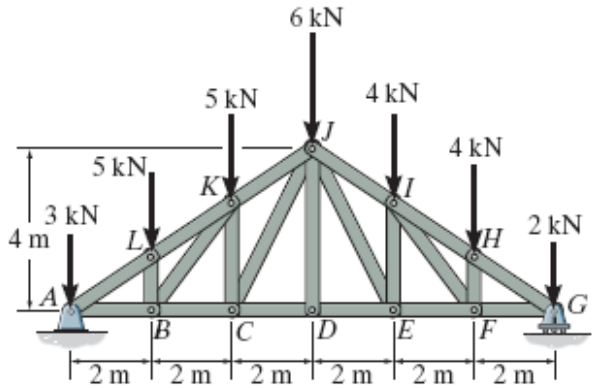
$$+\uparrow \Sigma F_y = 0; \quad F_{GD} - 7.071\sin 45° = 0$$
$$F_{GD} = 5.00 \text{ kN (T)} \qquad \text{Ans}$$


30 KN
20 KN
20 KN
40 KN
A_x
4 m
4 m
4 m
4 m
A_y
E_y


40 KN
4m
4 m
H
F_{HG}
F_{HD}
45°
4m
F_{CD}
$E_y = 45.0$ KN


y
$F_{HD} = 7.071$ KN
F_{GD}
45°
x
D
$F_{CD} = 50.0$ KN
F_{DE}

***6–49.** Determine the force in members kJ, KC, and BC, and state if the members are in tension or compression.



Support Reactions: Applying the equations of equilibrium to the free-body diagram of the truss, Fig. *a*,

$\overset{+}{\rightarrow}\Sigma F_x = 0;$ $\quad A_x = 0$

$(+\Sigma M_G = 0$ $\quad 3(12)+5(10)+5(8)+6(6)+4(4)+4(2)-A_y(12)=0$

$A_y = 15.5\ \text{kN}$

Method of Sections: Using the left portion of the free-body diagram, Fig. *a*.

$(+\Sigma M_C = 0;$ $\quad F_{KJ}\sin 33.69°(4)+5(2)+3(4)-15.5(4)=0$

$F_{KJ} = 18.03\ \text{kN} = 18.0\ \text{kN (C)}$ **Ans.**

$(+\Sigma M_A = 0;$ $\quad F_{KC}(4)-5(4)-5(2)=0$

$F_{KC} = 7.50\ \text{kN (C)}$ **Ans.**

$(+\Sigma M_K = 0;$ $\quad F_{BC}(2.667)+5(2)+3(4)-15.5(4)=0$

$F_{BC} = 15\ \text{kN (T)}$ **Ans.**