21-S-6-ZA-57 Solution

Question:

The truss system shown is acted upon by a force $F\ N$ at point B. If $a\ m$ and $b\ m$, find the reaction forces and state whether each member is in compression, tension, or is unloaded. Member AC is perpendicular to member BD.

Solution:

We can find the reaction forces by taking the sum of forces and moments of the whole system.

$\Sigma F_x = F + A_x = 0 \Rightarrow A_x = -F$

$\Sigma M_A = D_y a - Fb = 0 \Rightarrow D_y = Fb/a$

$\Sigma F_y = A_y + D_y \Rightarrow A_y = -D_y$

$R_D = Fb/a$

$R_A = ((-F)^2 + (-Fb/a)^2)^{1/2}$

Then, we use the method of joints to determine the forces in each member.

B: $\Sigma F_x = F - F_{BC} sin\theta = 0 \Rightarrow F_{BC} = F/sin\theta$ Tension

$\Sigma F_y = -F_{AB} + F_{BC} cos\theta = 0 \Rightarrow F_{AB} = F_{BC} cos\theta$ Compression

C: $F_{CD} = F_{BC}$ Tension

$F_{AC} = 0$ Unloaded

D: $\Sigma F_x = -F_{AD} + F_{CD} cos(90 - \theta) = 0 \Rightarrow F_{AD} = F_{CD} cos(90 - \theta)$ Compression