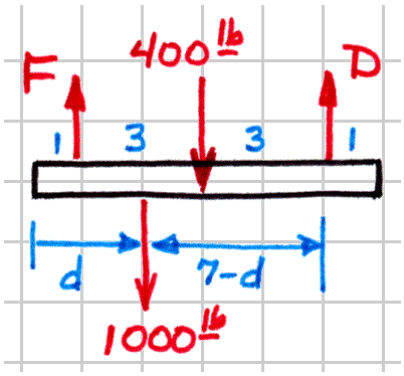
1-49

From a free-body diagram of the I-beam, the equations of equilibrium give



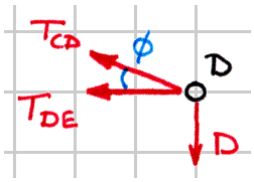
$$\circlearrowleft \Sigma M_D = 0: \qquad 400(3)+1000(7-d)+6F=0$$

$$\circlearrowleft \Sigma M_F = 0: \qquad 6D-1000(d-1)-400(3)=0$$

$$D=\frac{1000(d-1)+1200}{6}$$

$$F=\frac{1000(7-d)+1200}{6}$$

Next, from a free-body diagram of the joint *D*, the equations of equilibrium give



$$\rightarrow \Sigma F_x = 0: \qquad -T_{CD}\cos\phi - T_{DE} = 0$$

$$\uparrow \Sigma F_y = 0: \qquad T_{CD}\sin\phi - D = 0$$

$$T_{CD}=\frac{D}{\sin\phi} \qquad T_{DE}=\frac{-D}{\tan\phi}$$

in which

$$\phi=\tan^{-1}\frac{1}{3}=18.435^\circ$$

By inspection, members *CE* and *CF* are both zero-force members. Therefore the tension force in member *BC* will be the same as the tension force in member *CD* and the compression force in member *EF* will be the same as the compression force in member *DE*,

$$T_{BC}=\frac{D}{\sin\phi} \qquad T_{CF}=0$$

$$T_{EF}=\frac{-D}{\tan\phi}$$