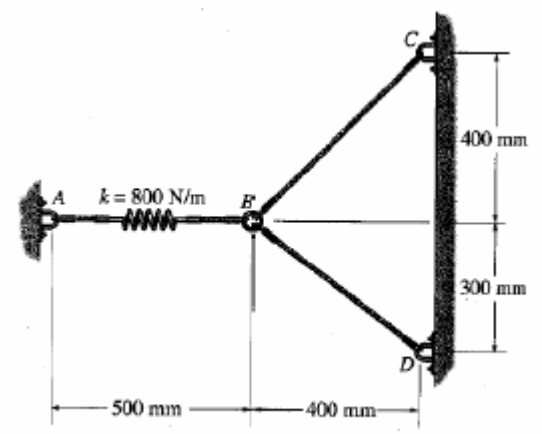
Q- (a) Draw the free-body diagram of the link at B. (b) if the spring has a stiffness of k=800 N/m and an unstretched length of 100 mm, determine the tension in cables *BC* and *BD* when the spring is held in the position shown.



Answer:

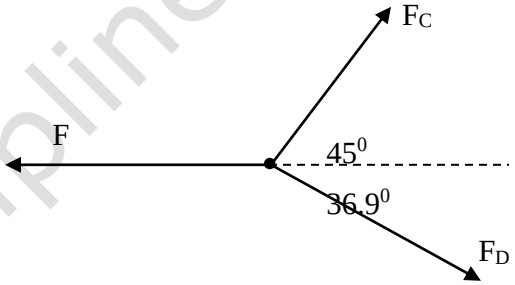
(a) The free body diagram of the link at B is shown in the figure bellow.

(b) The extension in the spring is

$\Delta l = 500 - 100 = 400$ mm $= 0.4$ m

hence tension in the spring is given by

$F = K \Delta l = 800*0.4 = 320$ N



Now the geometry of the diagram shows that the force Fc is making an angle

$\tan^{-1}(400/400) = 45^0$

and the force F_D is making an angle

$\tan^{-1}(300/400) = 36.9^0$ with the direction opposite to the force F

Now resolving the forces Fc and FD in the direction perpendicular and along the direction of F we have for equilibrium of point B in the direction perpendicular to F

$F_c \sin 45^0 - F_D \sin 36.9^0 = 0$

Or $F_c*0.707 = F_D*0.6$

Or $F_c = 0.849\, F_D$ ---------- (1)

Considering equilibrium of point B along the spring force F we have

$F_c*\cos 45^0 + F_D*\cos 36.9^0 - F = 0$

Or $F_c*0.707 + F_D*0.8 - 320 = 0$

Or $0.849*F_D*0.707 + 0.8F_D = 320$ {using equation 1}

Gives $F_D =$ **228.57 N**

And $F_c = 0.849*F_D =$ **194.05 N**