



**Problem 10**

In a screw jack, the pitch of the square threaded screw is 5.5 mm and the mean diameter is 70 mm. The force exerted in turning the screw is applied at the end of a lever 210 mm long measured from the axis of the screw. If the coefficient of friction of the screw jack is 0.07, calculate the force required at the end of the lever to

- (i) Raise the weight of 30KN
- (ii) Lower of the same weight.

**Solution**

Given

Pitch of the screw,  $P=5.5\text{mm}$

Diameter of the screw,  $d=70\text{mm}$

Length of the lever,  $L=210\text{mm}$

Weight,  $W=30\text{KN}$

Coefficient of friction  $\mu = 0.07$

Angle of friction  $\phi = \tan^{-1}(\mu)$

$$\phi = \tan^{-1}(0.07)$$

$$\phi = 4^\circ$$

$$\tan \alpha = \frac{p}{\pi d} = \frac{5.5}{\pi \times 70} = 0.025$$

$$\alpha = \tan^{-1}(0.025) = 1.4^\circ$$

- (i) Force required to raise the weight

$$P = \frac{Wr}{L} \tan(\phi + \alpha)$$



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$$P = \frac{30 \times 35}{210} [\tan(4 + 1.4)]$$

$$P = 0.4726 \text{ KN}$$

(ii) Force required to lower the weight

$$P = \frac{Wr}{L} (\tan(\phi - \alpha))$$
$$= \frac{30 \times 35}{L} (\tan(4 - 1.4))$$

$$P = 0.227 \text{ KN}$$