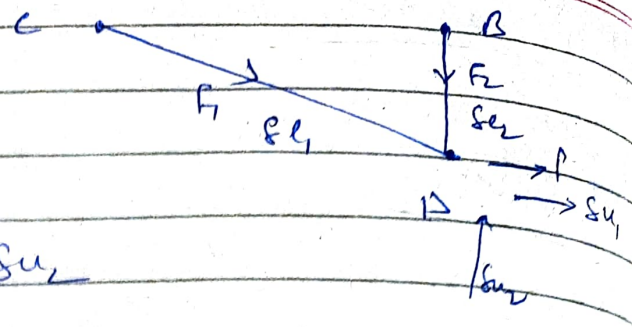
Q1.) Real system



$$F_1 \delta l_1 + F_2 \delta l_2 = P_1 \delta u_1$$

$$\delta l_2 = -\delta u_2$$

$$\delta l_1 = \delta u_1 \cos 30' - \delta u_2 \sin 30'$$

$$F_1 (\delta u_1 \cos 30' - \delta u_2 \sin 30') + F_2 (-\delta u_2) = P_1 \delta u_1$$

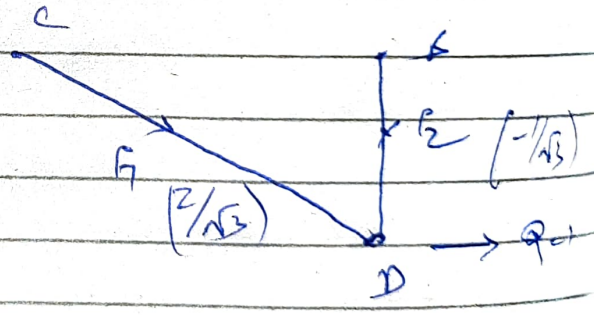
$$\Rightarrow (F_1 \cos 30 - P_1)\, \delta u_1 + (-F_1 \sin 30' - F_2)\, \delta u_2 = 0$$

$$\therefore F_1 = \frac{2P}{\sqrt{3}} \qquad F_2 = -\frac{P}{\sqrt{3}}$$

Virtual system

from previous part

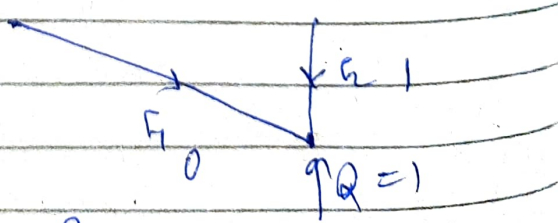
$$F_1 = \frac{2Q}{\sqrt{3}}, F_2 = -\frac{Q}{\sqrt{3}}$$



$$F_1 (\delta u_1 \cos 30 - \delta u_2 \sin 30') + F_2 (-\delta u_2) = Q \delta u_2$$

$F_1 \cos 30' = 0$

$$F_2 = -(Q + F_1 \sin\theta) = -Q$$



Member	N	n_V	n_H	Nn_V	Nn_H
1) CD	$2P/\sqrt{3}$	0	$2/\sqrt{3}$	0	$4P/3$
2) BD	$-P/\sqrt{3}$	-1	$-1/\sqrt{3}$	$P/\sqrt{3}$	$P/3$

Net Extension →

BD

$$(\delta_D)_x \Rightarrow \sum N n_H \times \frac{L}{AE} \Rightarrow \frac{5PL}{3AE}$$

$$(\delta_D)_y = \sum N n_V \times \frac{L}{AE} \Rightarrow \frac{PL}{\sqrt{3}AE}$$

Net Extension →

$$\sqrt{(\delta_D)_x^2 + (\delta_D)_y^2}$$

$$\Rightarrow \frac{PL}{AE}\sqrt{\frac{25}{9} + \frac{1}{3}} \Rightarrow \frac{\sqrt{28}\,PL}{3AE}$$