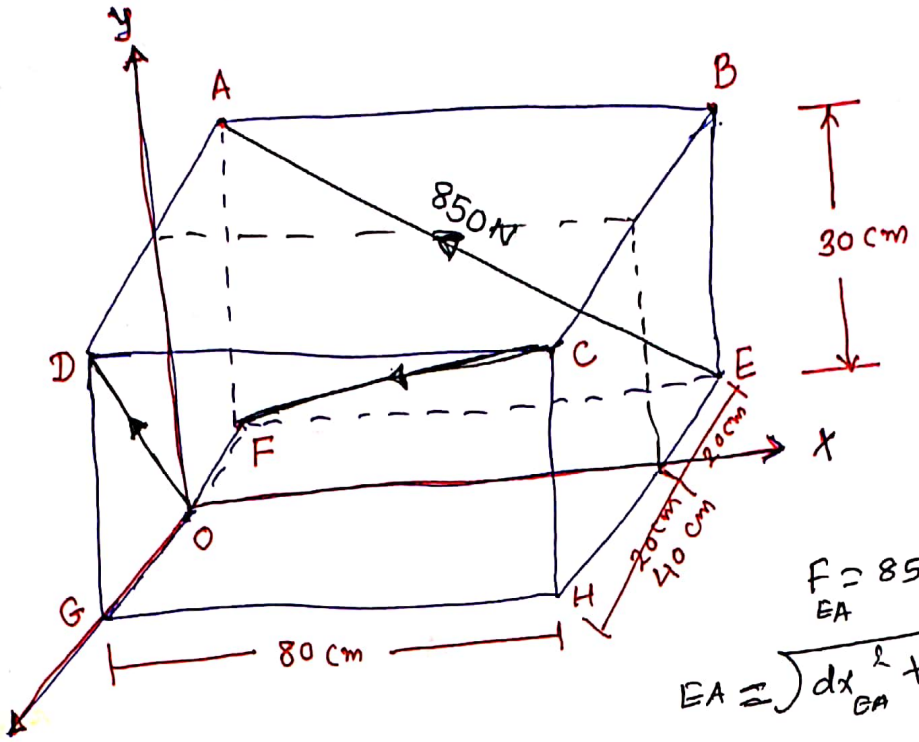
Force of 850 N act as shown in Fig.

Determine moment about (i) Origin (ii) Point H
(iii) Axis OD and (iv) Axis CF

O(0, 0, 0)
A(0, 30, -20)
B(80, 30, -20)
C(80, 30, 20)
D(0, 30, 20)
E(80, 0, -20)
F(0, 0, -20)
G(0, 0, 20)
H(80, 0, 20)



$F_{EA} = 850\ N$

$EA = \sqrt{dx_{EA}^2 + dy_{EA}^2 + dz_{EA}^2}$

$dx_{EA} = 0 - 80 = -80$

$dy_{EA} = 30 - 0 = 30$

$dz_{EA} = -20 - (-20) = 0$

$EA = d = \sqrt{-80^2 + 30^2 + 0^2}$

$d = 85.44\ m$

$F_x = F \cdot \frac{dx}{d} = \frac{850 \times -80}{85.44} = -795.88\ N$

$F_y = F \cdot \frac{dy}{d} = \frac{850 \times 30}{85.44} = 298.46\ N$

$F_z = 0$

(1)

$$\bar{M}_O = \begin{vmatrix} i & j & k \\ x_E & y_E & z_E \\ F_x & F_y & F_z \end{vmatrix}$$

$$\bar{M}_O = \begin{vmatrix} i & j & k \\ 80 & 0 & 20 \\ -795.88 & 298.46 & 0 \end{vmatrix} = (5969.20\,i + 15917.60\,j + 23876.8\,k)\ N.cm$$

(2) Moment about point H

$$\bar{M}_H = \begin{vmatrix} i & j & k \\ x_{E/H} & y_{E/H} & z_{E/H} \\ F_x & F_y & F_z \end{vmatrix} = \begin{vmatrix} i & j & k \\ 0 & 0 & -40 \\ -795.88 & 298.46 & 0 \end{vmatrix} = (11938.40\,i + 31835.20\,j)\ N.cm$$

③ Moment about Axis OD

$$M_{OD} = \begin{vmatrix} \lambda_x & \lambda_y & \lambda_z \\ x_E & y_E & z_E \\ F_x & F_y & F_z \end{vmatrix} \Rightarrow$$

$$\lambda_x = \frac{dx}{d} = \frac{x_D - x_O}{d_{OD}} \Rightarrow$$

$$\lambda_y = \frac{dy}{d} = \frac{y_D - y_O}{d_{OD}}, \quad \lambda_z = \frac{z_D - z_O}{d_{OD}}$$

$x_D - x_O = 0 - 0 = 0$

$y_D - y_O = 30, \quad z_D - z_O = 20$

$d_{OD} = \sqrt{30^2 + 20^2}$

$d_{OD} = 36.05 \text{ cm}$

$\lambda_x = 0, \quad \lambda_y = \frac{30}{36.05} = 0.832, \quad \lambda_z = \frac{20}{36.05} = 0.555$

$$M_{OD} = \begin{vmatrix} 0 & 0.832 & 0.555 \\ 80 & 0 & -20 \\ -795.88 & 298.46 & 0 \end{vmatrix} = 2.65 \times 10^{4} \text{ N.cm} = 2.65 \times 10^{4} \text{ N.cm}$$

④ Moment about axis CF

$$M_{CF} = \begin{vmatrix} \lambda_x & \lambda_y & \lambda_z \\ x_{E/C} & y_{E/C} & z_{E/C} \\ F_x & F_y & F_z \end{vmatrix}$$

$$\lambda_x = \frac{dx}{d} = \frac{x_F - x_C}{d_{FC}}$$

$$\lambda_y = \frac{y_F - y_C}{d_{FC}}, \quad \lambda_z = \frac{z_F - z_C}{d_{FC}}$$

$$M_{CF} = \begin{vmatrix} -0.85 & -0.32 & -0.42 \\ 0 & -30 & -40 \\ -795.88 & 298.46 & 0 \end{vmatrix} = -10306.82 \text{ N.cm}$$