



2/20/2024

ENGINEERING ANALYSIS II (EA2)

Lecture # 26: Ch6. Structures in Equilibrium

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Lecture Outlines:

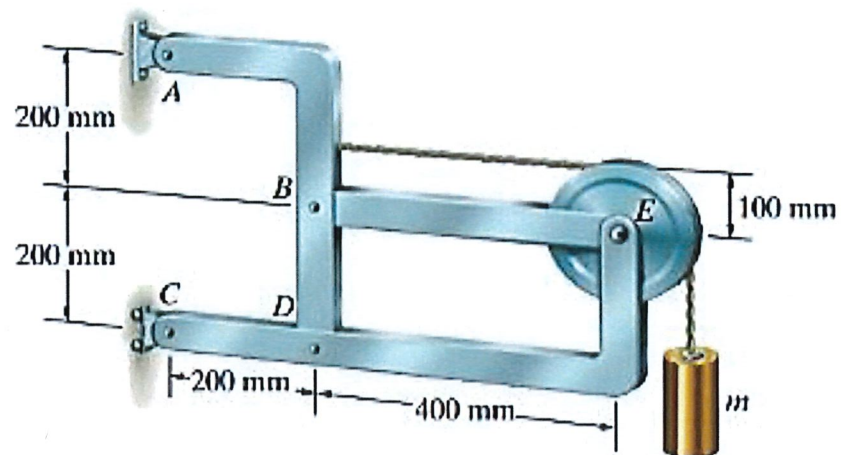
1. Frame Class Example 3.

References:

1. Bedford, A., & Fowler, W. *Engineering Mechanics: Statics* (5th ed.).
2. Prof. Alarcon's lecture notes.

class problem 3

6.87 The mass $m = 12$ kg. Determine the forces on member CDE .



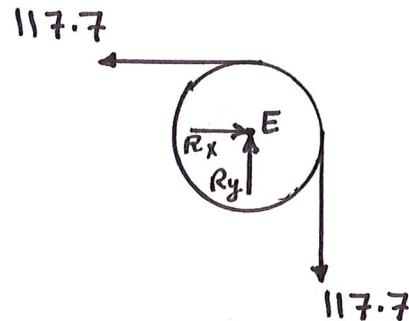
1) Pully at E:-

$$W = m * g$$

$$= 12 * 9.81 = \underline{117.7 \text{ N}}$$

$$\sum F_x = 0 \quad \therefore \underline{R_x = 117.7 \text{ N}}$$

$$\sum F_y = 0 \quad \therefore \underline{R_y = 117.7 \text{ N}}$$



[2] FBD of the whole frame.

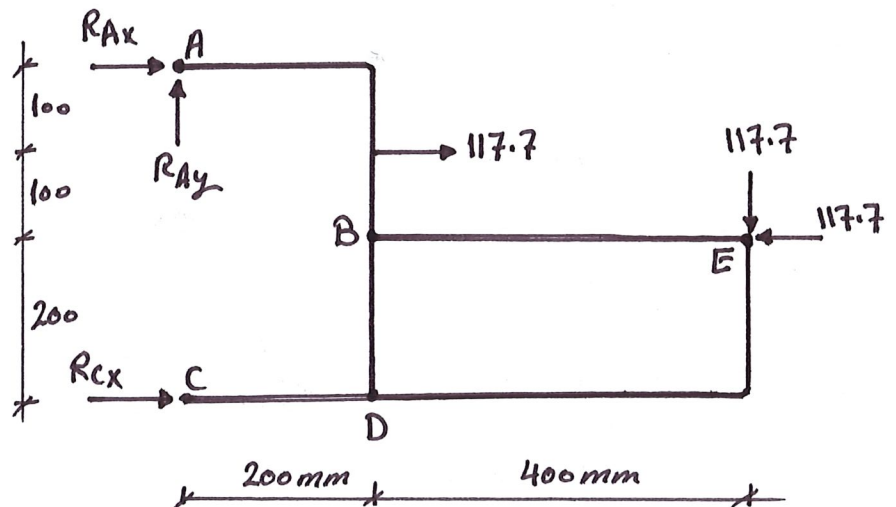
$$\curvearrowright \sum M_A = 0$$

$$\therefore 117.7 * 100 - 117.7 * 600 - 117.7 * 200 + R_{Cx} * 400 = 0$$

$$\boxed{\therefore R_{Cx} = 206 \text{ N}}$$

$$\uparrow \sum F_y = 0$$

$$\therefore R_{Ay} - 117.7 = 0 \quad \therefore \underline{R_{Ay} = 117.7 \text{ N}}$$

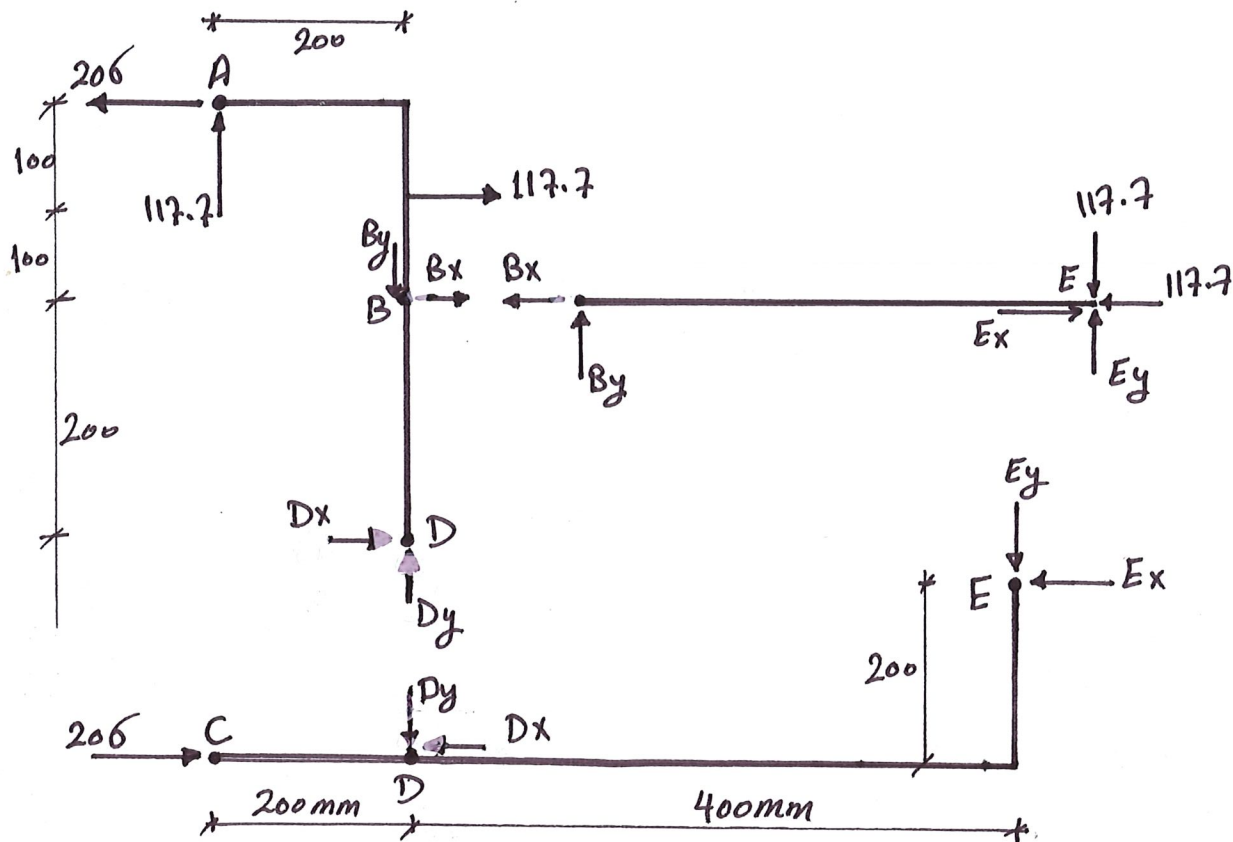


$$\rightarrow \sum F_x = 0$$

$$\therefore R_{Ax} + 117.7 - 117.7 + 206 = 0$$

$$\therefore \underline{R_{Ax} = -206 \text{ N}}$$

3) FBD of each member:-



For member ABD:-

$$\Rightarrow \sum M_B = 0 \quad \therefore 206 \times 200 - 117.7 \times 200 - 117.7 \times 100 + D_x \times 200 = 0$$

$$\therefore \boxed{D_x = -29.45 \text{ N}}$$

$$\Rightarrow \sum F_x = 0 \quad \therefore -206 + 117.7 + B_x + D_x = 0$$

$$\therefore \underline{B_x = 117.75 \text{ N}}$$

For member CDE :-

$$\Rightarrow \sum F_x = 0$$

$$\therefore 206 - \overset{-29.45}{D_x} - E_x = 0 \quad \therefore \boxed{E_x = 235.45 \text{ N}}$$

$$\Rightarrow \sum M_D = 0$$

$$\therefore \overset{235.45}{E_x} * 200 - E_y * 400 = 0$$

$$\therefore \boxed{E_y = 117.7 \text{ N}}$$

$$\Rightarrow \sum F_y = 0$$

$$\therefore -D_y - \overset{117.7}{E_y} = 0 \quad \therefore \boxed{D_y = -117.7 \text{ N}}$$

So, the forces on member CDE are:

