Universidad de Chile
Facultad de Ciencias Físicas y Matemáticas
Departamento de Ingeniería Mecánica

ME46A-02 Resistencia de Materiales
Profesor Cátedra : Francisco Escandón A.
Profesor Auxiliar : Felipe Donoso O.

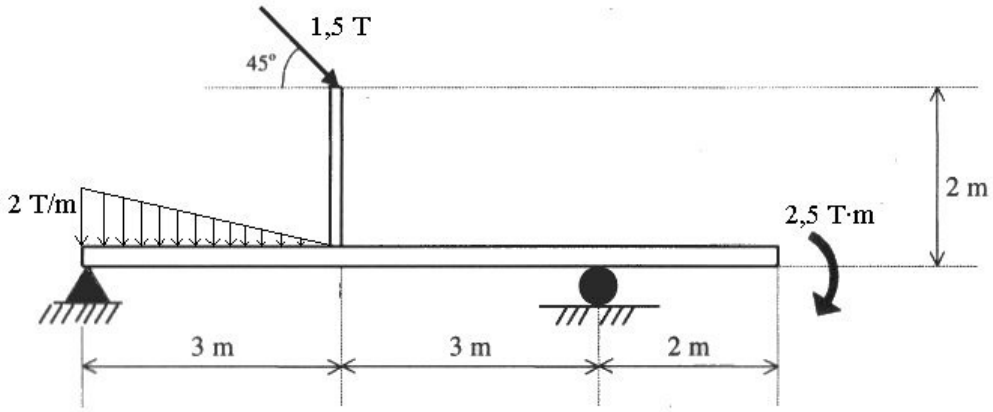
Semestre Otoño 2007

(21 de Marzo)

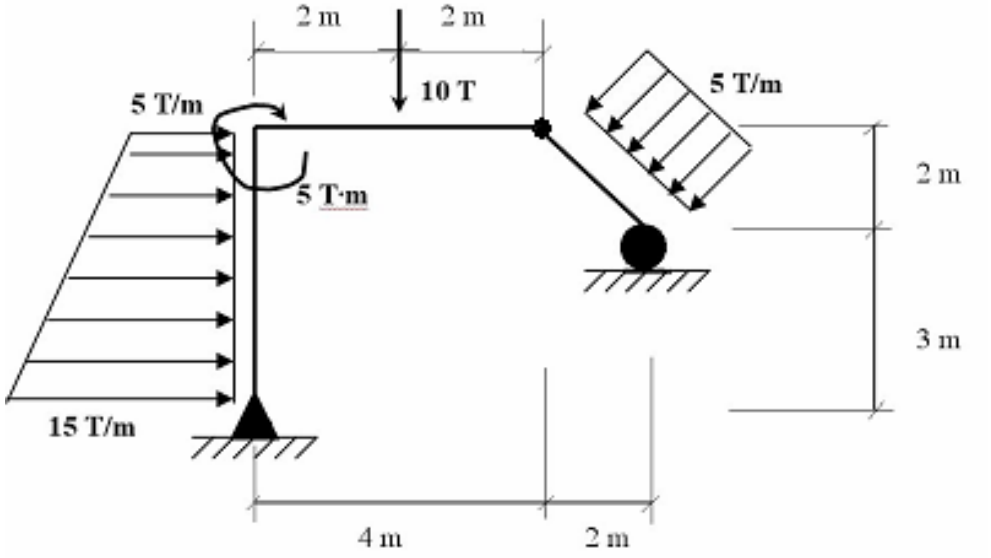
Clase Auxiliar N°1

Calcular todas las reacciones de los problemas 1 y 2:

Problema N° 1

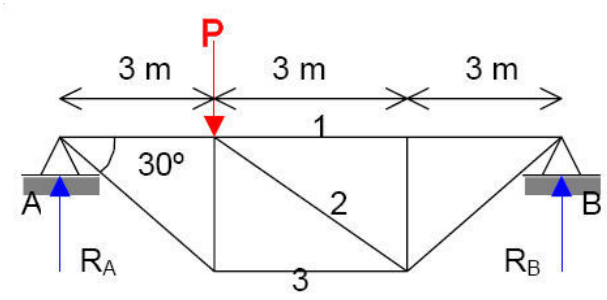


Problema N° 2



Problema N° 3

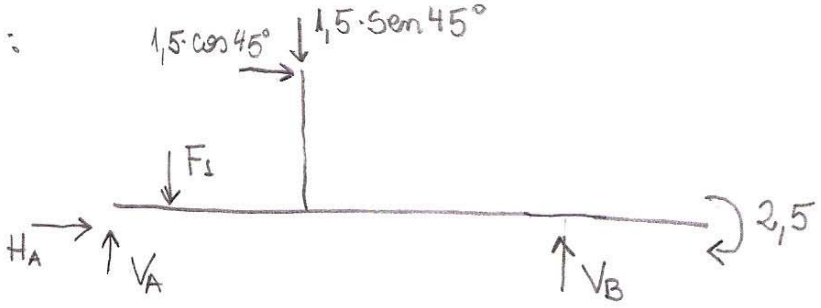
Dada la figura, calcular las reacciones en los apoyos y las fuerzas que soportan las barras 1, 2 y 3. Además diga cuales de estas barras están sometidas a compresión y a tracción.
P = 6000 Kg.



Pauta Ejercicio 1
ME46A-02 Otoño 2006-1

Problema 1

DCL:



$\Sigma F_x = 0 \Rightarrow H_A + 1{,}5\cos 45° = 0$

$\Sigma F_y = 0 \Rightarrow V_A + V_B - F_1 - 1{,}5 \cdot \text{Sen}\,45° = 0$

$\Sigma M_z = 0 \Rightarrow -\frac{3}{3} F_1 = 3 \cdot 1{,}5 \text{sen}45° + 6 V_B - 2{,}5 - 2 \cdot 1{,}5 \cos 45° = 0$

$F_1 = \frac{2 \cdot 3}{2} = 3\,[\text{Ton}]$

$\Rightarrow$

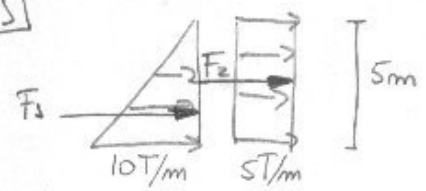
$H_A = -1{,}06\,[\text{Ton}]$

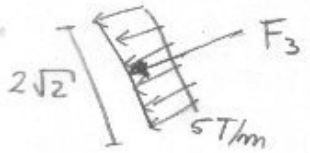
$V_A = 2{,}26\,[\text{Ton}]$

$V_B = 1{,}8\,[\text{Ton}]$

Pauta Ejercicio 1
ME46A - Otoño '04

P1





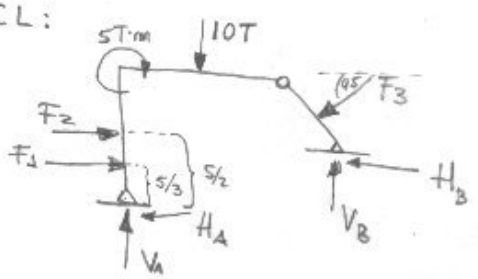
1pto

$F_1 = \frac{10 \cdot 5}{2} = 25T$

$F_2 = 5 \cdot 5 = 25T$

$F_3 = 10\sqrt{2}\ T$

=> DCL:



1pto

$\Rightarrow \sum F_x = 0 \Rightarrow F_1 + F_2 - H_A - F_3 \cdot \cos 45 - H_B = 0$

$H_A + H_B = 40$ (1) — 0,75 ptos

$\sum F_y = 0 \Rightarrow V_A - 10 - F_3 \cdot \operatorname{sen} 45 + V_B = 0$

$V_A + V_B = 20$ (2) — 0,75 ptos

$\sum M_A = 0 \Rightarrow -\frac{5}{3}F_1 - \frac{5}{2} \cdot F_2 - 5 - 2 \cdot 10 + 4 \cdot F_3 \cdot \cos 45 - 5 \cdot F_3 \cdot \operatorname{sen} 45 + 6 \cdot V_B + 3 \cdot H_B = 0$

$\Rightarrow 6\,V_B + 3\,H_B = 139,17$ (3) — 0,75 ptos

$\sum M_{\text{rotula derecha}} = 0 \Rightarrow 2 \cdot V_B - 2 \cdot H_B - 1 \cdot F_2 \cdot \cos 45 - 1 \cdot F_3 \cdot \operatorname{sen} 45 = 0$

$V_B - H_B = 10$ (4) — 0,75 ptos

③ y ④

$\Rightarrow V_B = 10 + H_B \Rightarrow 6(10+H_B) + 3H_B = 139,17$

$60 + 6H_B + 3H_B = 139,17$

$H_B = 8,79\,T$

$V_B = 18,79\,T$

$H_A = 40 - H_B \Rightarrow H_A = 31,2\,T$

$V_A = 20 - V_B \Rightarrow V_A = 1,2\,T$

1 pto

Felipe Donoso O.

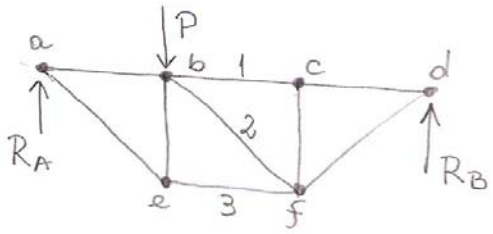
Problema 2

$\Sigma F_x = 0 \Rightarrow 0 = 0$

$\Sigma F_y = 0 \Rightarrow R_A + R_B - P = 0$

$\Sigma M_z = 0 \Rightarrow -3P + 9R_B = 0$

$P = 6000\ [Kg]$

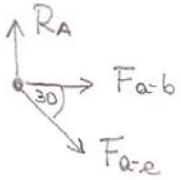


$\Rightarrow R_A = 4000\ [Kg]$

$R_B = 2000\ [Kg]$

Por método de los nodos:

Nodo a:

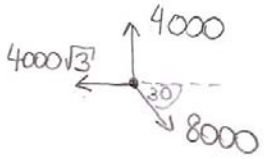


$\Sigma F_x = 0 \Rightarrow F_{a-b} + F_{a-e} \cdot \cos 30° = 0$

$\Sigma F_y = 0 \Rightarrow R_A - F_{a-e} \cdot \operatorname{sen} 30° = 0$

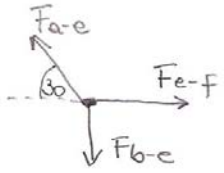
$\Rightarrow F_{a-e} = 8000\ [Kg]$

$F_{a-b} = -4000\sqrt{3}\ [Kg]$



$\Rightarrow$ barra a-b sometida a compresión
barra a-e sometida a tracción

Nodo e:

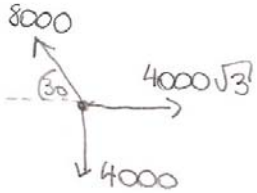


$\Sigma F_x = 0 \Rightarrow F_{e-f} - F_{a-e} \cdot \cos 30° = 0$

$\Sigma F_y = 0 \Rightarrow F_{a-e} \cdot \operatorname{sen} 30° - F_{b-e} = 0$

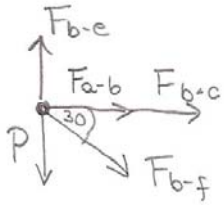
$\Rightarrow F_{b-e} = 4000\ [Kg]$

$F_{e-f} = 4000\sqrt{3}\ [Kg]$



$\Rightarrow$ barra e-f sometida a tracción
barra a-e sometida a compresión

Modo b:

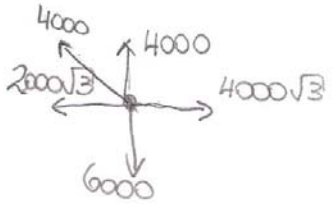


$\Sigma F_x = 0 \Rightarrow F_{a-b} + F_{b-c} + F_{b-f} \cdot \cos 30^\circ = 0$

$\Sigma F_y = 0 \Rightarrow -F_{b-f} \cdot \operatorname{sen} 30^\circ - P + F_{b-e} = 0$

$\Rightarrow F_{b-c} = -2000\sqrt{3}\ [Kg]$

$F_{b-f} = -4000\ [Kg]$



$\Rightarrow$ barra b-c sometida a compresión

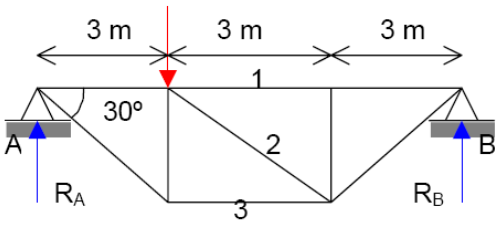
barra b-f sometida a compresión

$\therefore$ Barra 1: Sometida a una compresión de $2000\sqrt{3}$ [Kg]

Barra 2: " " " compresión de 4000 [Kg]

Barra 3: " " " tracción de $4000\sqrt{3}$ [Kg]

Otra forma de hacer este problema:



$\Sigma F_v = 0 \Rightarrow R_A + R_B - p = 0$

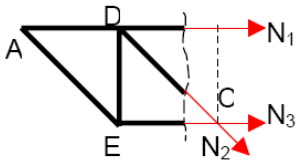
$\Sigma F_h = 0 \Rightarrow 0 = 0$

$\Sigma M = 0 \Rightarrow M_A = 0 = 9R_B - 3p = 0$

$M_B = 0 = 9R_A - 6p = 0$

$R_B = p/3 = 2000Kg$; $R_A = 4000Kg$.

Para resolverlo utilizamos el método de Ritte.



$\Sigma F_v = 0 \Rightarrow R_A - p - N_2 \operatorname{sen} 30 = 0$

$$\frac{2}{3}p - p - N_2\frac{1}{2} = 0; \quad N_2 = -\frac{2}{3}p = -4000Kg.$$

$\Sigma F_h = 0 \Rightarrow N_1 + N_2 \cos 30 + N_3 = 0$

$$M_c = 0 = N_1\overline{DE} - p\overline{EC} + R_A\overline{AF}; \quad N_1 = -2000\sqrt{3}Kg.$$

$N_3 = 4000\sqrt{3}Kg. \quad \Rightarrow N_3 > |N_2| > |N_1| \Rightarrow S_3 > S_2 > S_1$