1/12/2024

# ENGINEERING ANALYSIS II (EA2)

## Lecture # 06: Ch3: Forces

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Lecture Outlines:

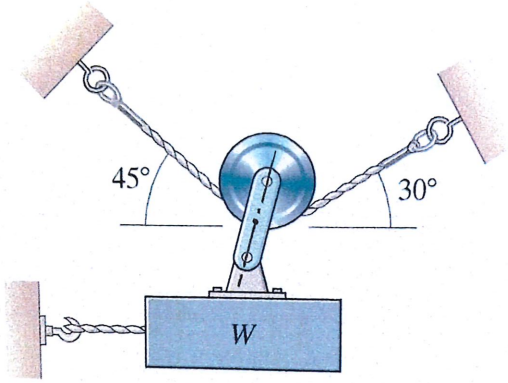
1. Class Problem 3.
2. Class problem 4.

References:

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

## class example 3

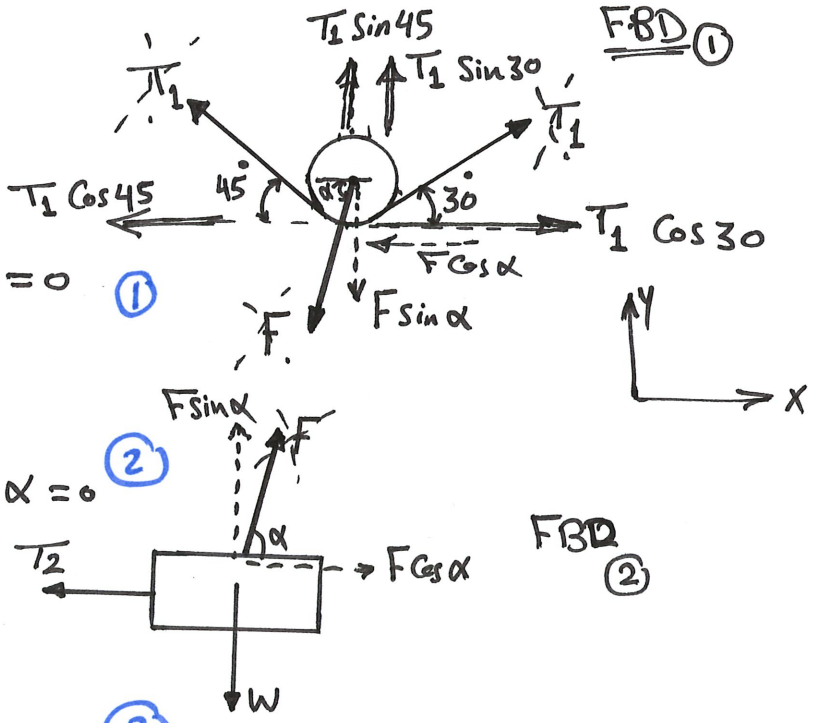
What are the tensions in the upper and lower cables?
(Your answer will be in terms of W.
Neglect the weight of the pulley.)




### Method 1

Sol.

[1] FBD ①




$\Rightarrow \Sigma F_x = 0$

$T_1 \cos 30 - T_1 \cos 45 - F \cos\alpha = 0$ ①

$\Rightarrow \Sigma F_y = 0$

$\therefore T_1 \sin 30 + T_1 \sin 45 - F \sin\alpha = 0$ ②

[2] FBD ②

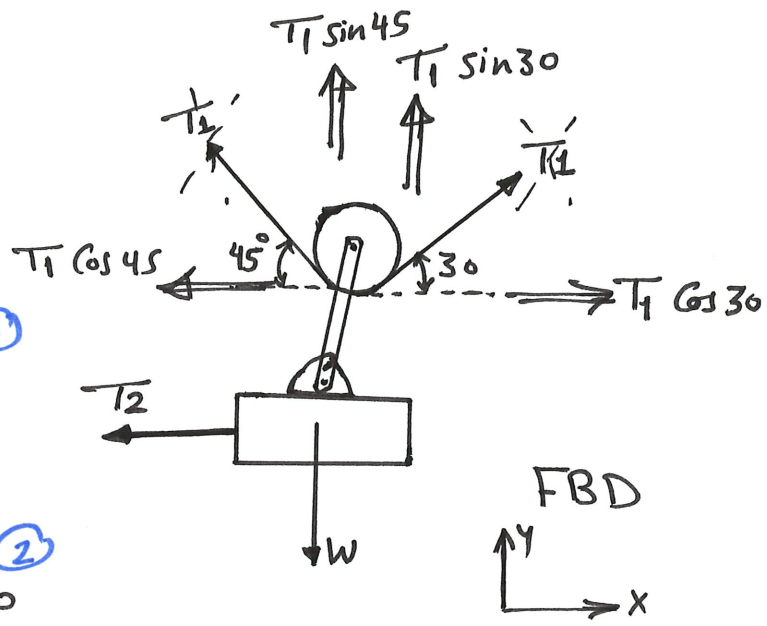
$\Sigma F_x = 0 \quad \therefore F \cos\alpha - T_2 = 0$ ③

$\Sigma F_y = 0 \quad \therefore F \sin\alpha - W = 0$ ④

4 equation & 4 unknowns $(T_1, T_2, F, \alpha) \Rightarrow$ Long solution to solve 4 equation

Method 2 faster

## Method 2 : All Combined




$\Sigma F_x = 0$

$\therefore T_1 \cos 30 - T_1 \cos 45 - T_2 = 0$ (1)

$\Sigma F_y = 0$

$\therefore T_1 \sin 45 + T_1 \sin 30 - W = 0$ (2)

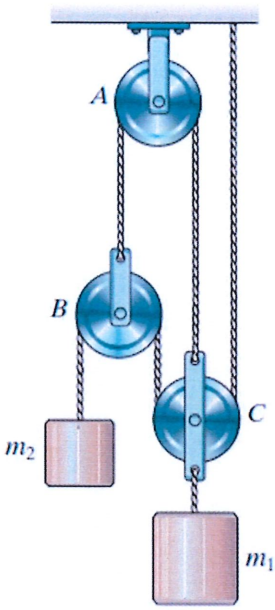
2 equations + 2 unknowns ($T_1$ & $T_2$)

From eqn (2): $\boxed{T_1 = 0.828W}$

Sub in (1) $\boxed{\therefore T_2 = 0.132W}$

## class example 4:-

The suspended mass $m_1 = 50$ kg. Neglecting the masses of the pulleys, determine the value of the mass $m_2$ necessary for the system to be in equilibrium.



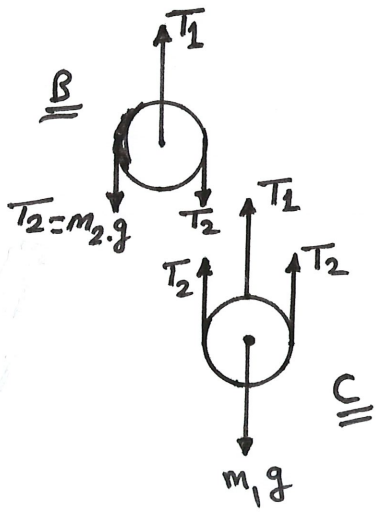

Sol.

Pulley (C):-

$\Sigma F_y = 0$

$\therefore T_1 + 2T_2 - m_1 g = 0$

$\therefore T_1 + 2T_2 = m_1 g \rightarrow (1)$




FBD

Pulley (B):-

$\Sigma F_y = 0$

$\therefore T_1 - T_2 - T_2 = 0$

$\therefore T_1 - 2T_2 = 0 \rightarrow \boxed{T_1 = 2T_2}$

Sub in (1)

$\therefore 2T_2 + 2T_2 = m_1 g \quad \therefore 4T_2 = m_1 g$

but $T_2 = m_2 g$, $\therefore 4m_2 g = m_1 g \quad \therefore m_2 = \frac{m_1}{4} = \frac{50}{4} = \boxed{12.5 \text{ kg}}$