WEDGE FRICTION

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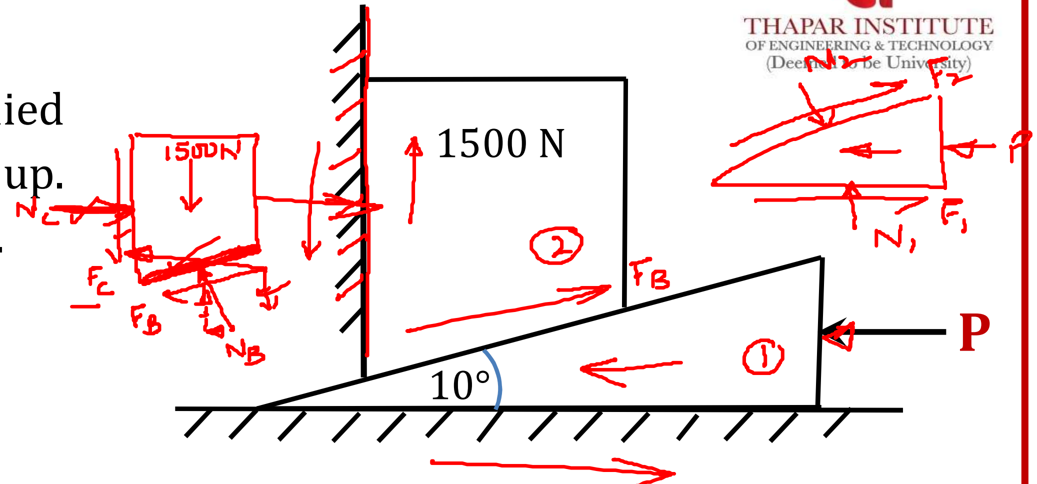
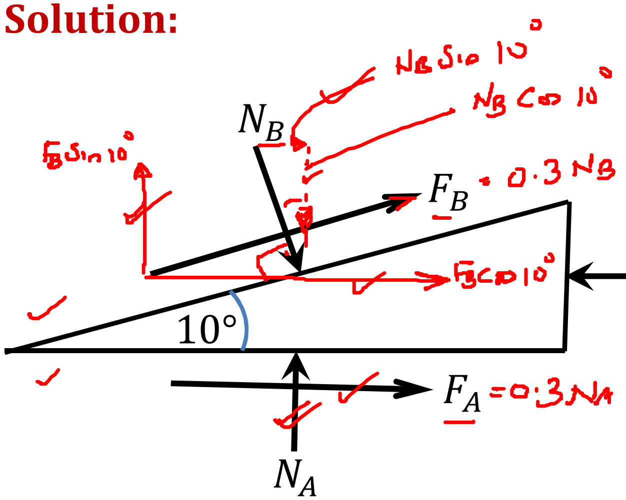


Example: Find out the minimum horizontal force 'P' applied at the wedge, required to lift the block weighing 1500 N up. Angle of wedge is given as 10° and μ for all surfaces is 0.3.

Solution:



$\Sigma F_x = 0$

$0.3 N_A + 0.3 N_B \cos 10 + N_B \sin 10 = P$ — I

$\Sigma F_y = 0$

$N_A + 0.3 N_B \sin 10 - N_B \cos 10 = 0$

$N_A = \quad N_B$ — II

$\Sigma F_y = 0$

$N_B \cos 10 - 0.3 N_B \sin 10 - 0.3 N_C = 1500$ — III

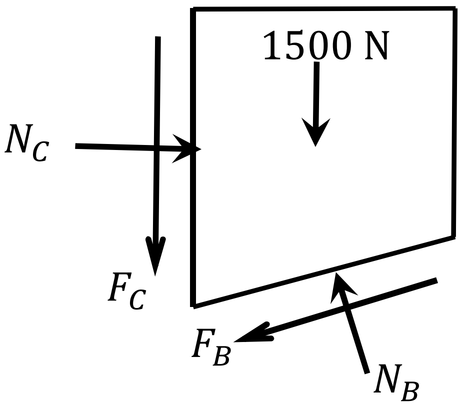
$\Sigma F_x = 0$

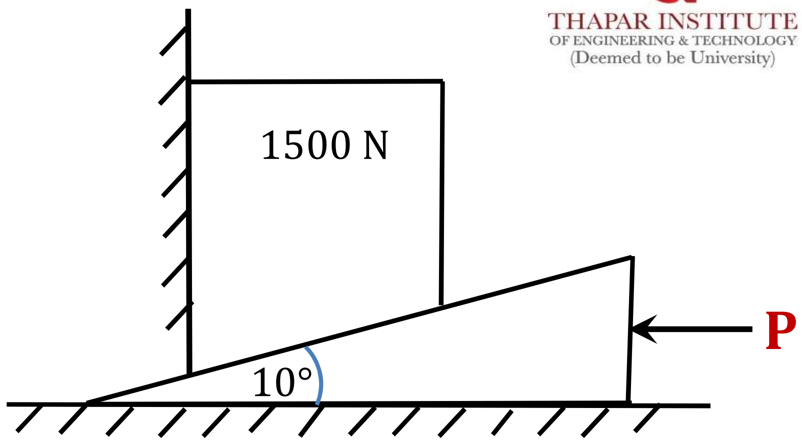
$N_C - 0.3 N_B \cos 10 - N_B \sin 10 = 0$

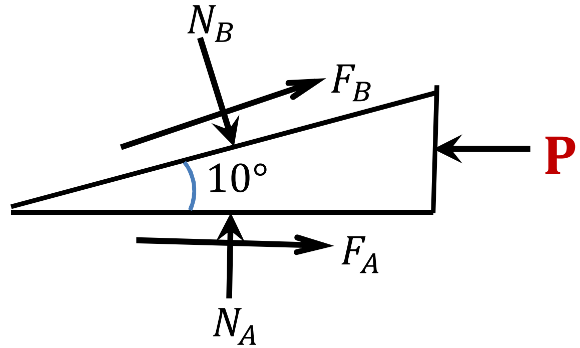
$N_C = \text{---} N_B$ — IV

Put in eqn – III → N_B

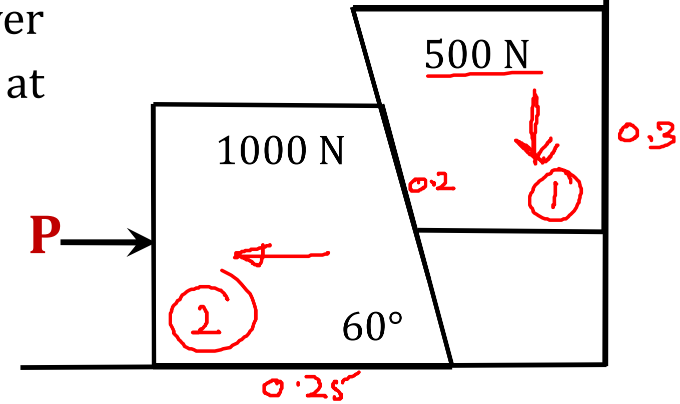
$N_B = 1893.94$ N, Put in eqn I $\Rightarrow P = 1418.18$ N


1500 N
N_C
F_C
F_B
N_B


1500 N
10°
P

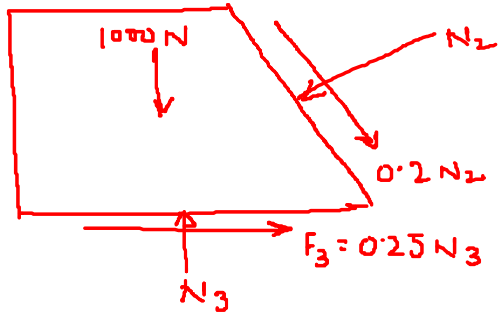

N_B
F_B
10°
P
F_A
N_A

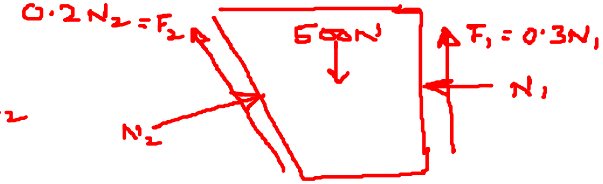
Example: Determine the minimum horizontal force 'P' applied at the lower block to hold the system in equilibrium. The coefficients of friction are 0.25 at the floor. 0.30 for the wall and 0.20 between the interface of the two blocks.



Solution: $\mu_f = 0.25$ $\mu_w = 0.30$ $\mu_b = 0.20$

$N_2 = 553.71\ N$
$N_3 = 1372.78\ N$
$P = 80.36\ N$





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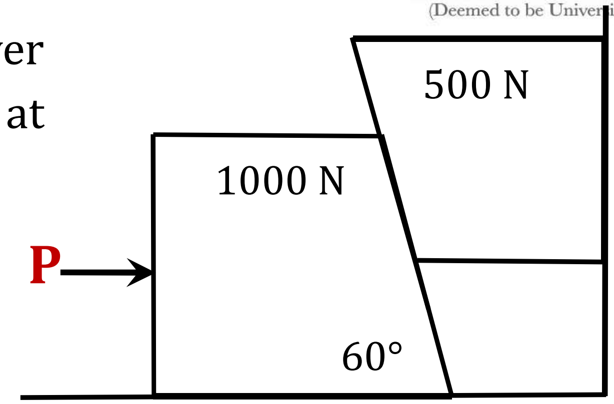

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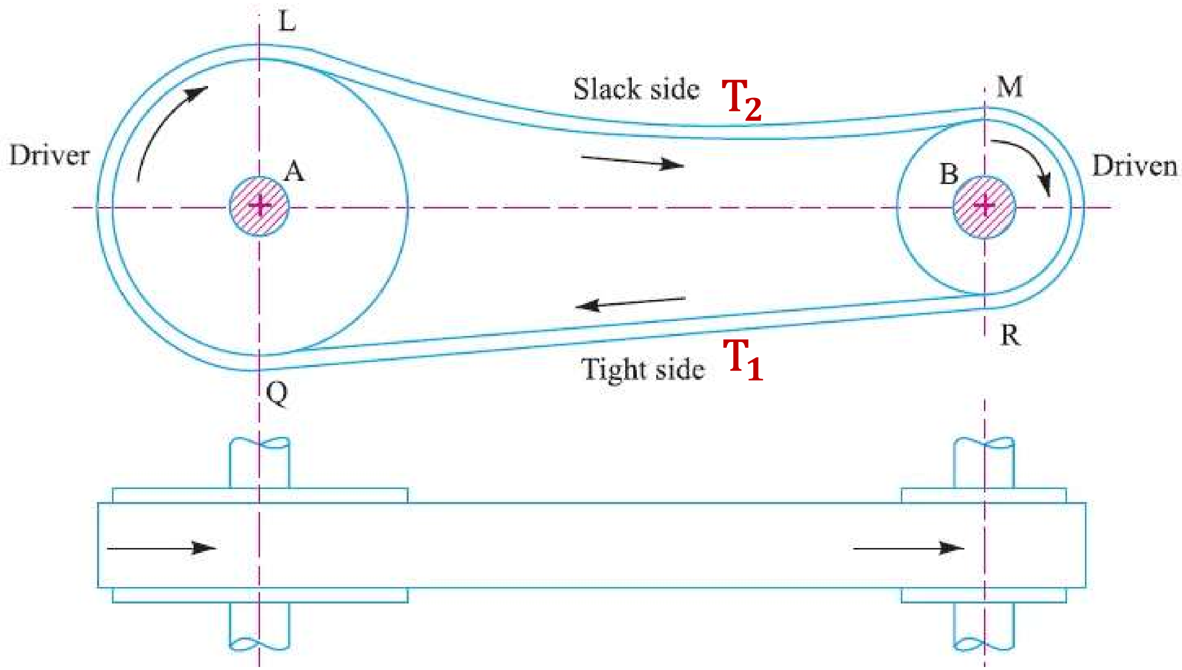
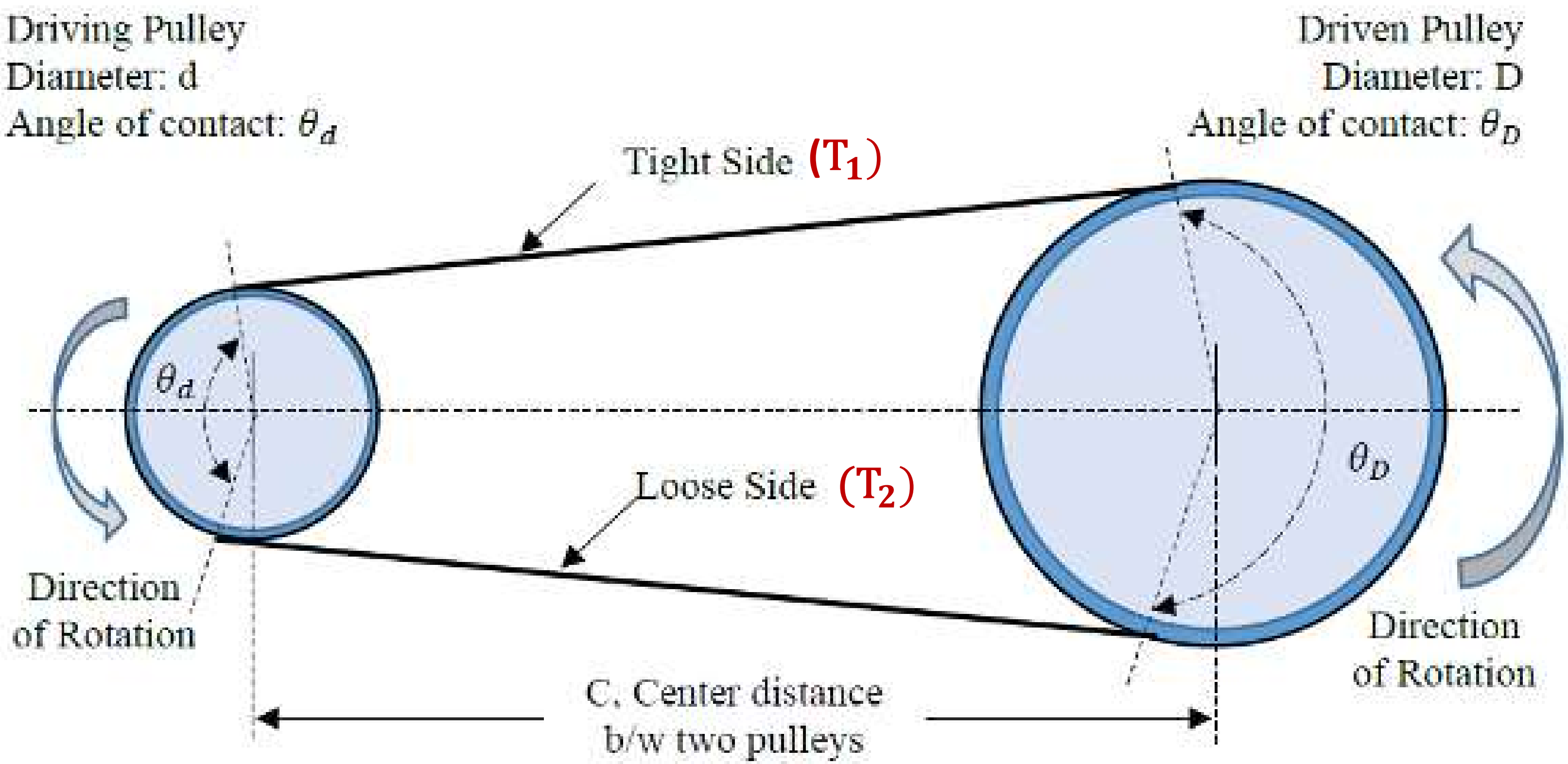
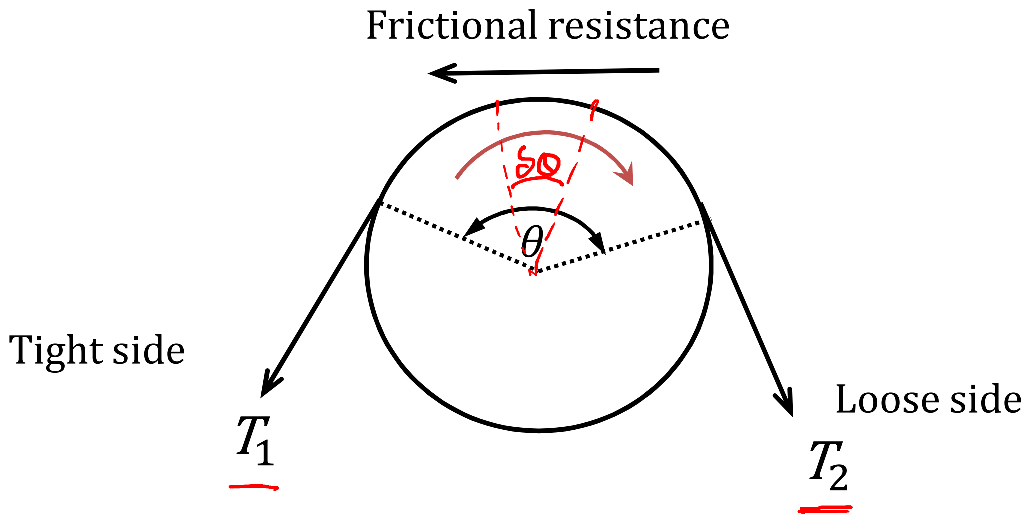
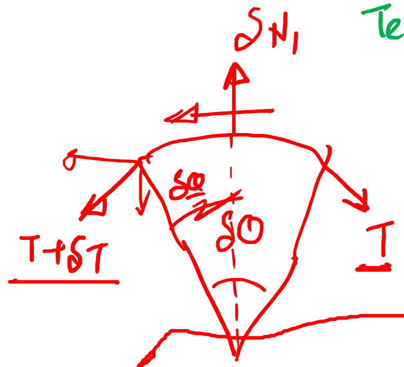
BELT FRICTION

Power is transmitted through belts and pulleys by the frictional resistance between belt and the pulley




Driving Pulley
Diameter: d
Angle of contact: θ_d
Driven Pulley
Diameter: D
Angle of contact: θ_D
Tight Side (T_1)
Loose Side (T_2)
θ_d
θ_D
Direction of Rotation
Direction of Rotation
C, Center distance b/w two pulleys





Tension on tight side

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

coeff. of frict

Tension on loose side

Angle of wrap (radian)

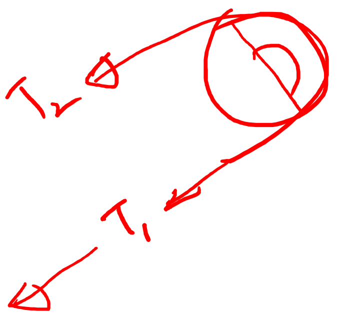
$$\boxed{T_1 = T_2 \cdot e^{\mu\theta}}$$

Angle of contact (radian)

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

Coeff of friction

W = 182.72 N



$$\frac{T_1}{T_2} = e^{\mu\theta}$$

$$T_1 = T_2 e^{0.25\times\pi}$$

$$\frac{T_1}{T_2} = 2.193$$

Angle of wrap

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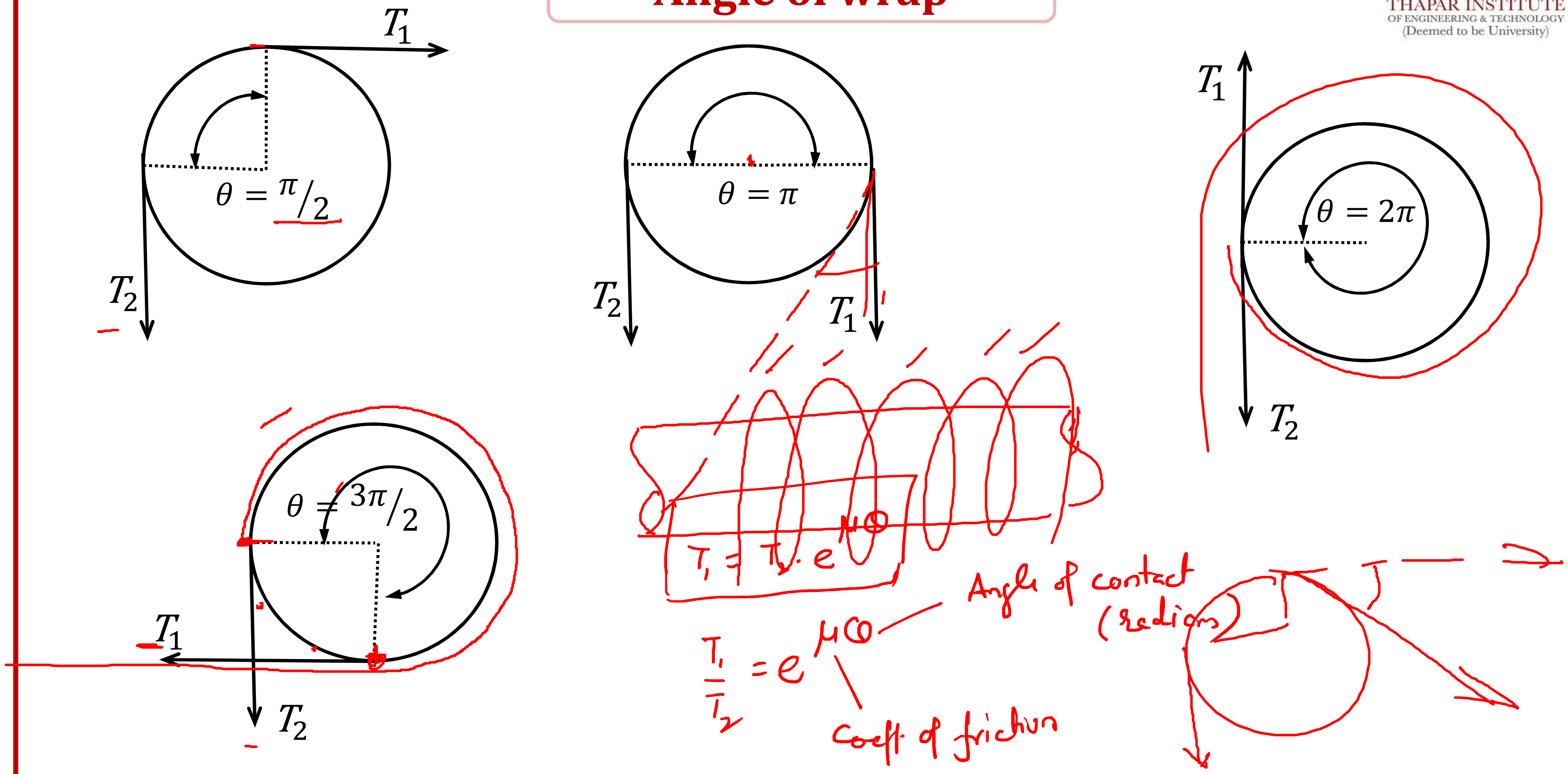


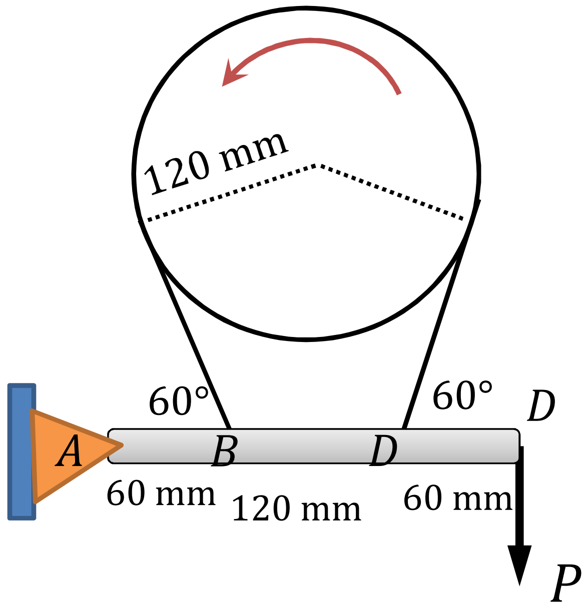
$T_1 = T_2 \cdot e^{\mu\theta}$

$\frac{T_1}{T_2} = e^{\mu\theta}$

Angle of contact (radians)

Coeff. of friction

Example: A flexible belt placed around a rotating drum of 120 mm radius acts as a brake, when the arm *ABCD* is pulled down by the force *P*. If the coefficient of friction is 0.2, determine the force '*P*' that would result in a braking torque of 12000 N-m. Neglect weight of the braking arm.



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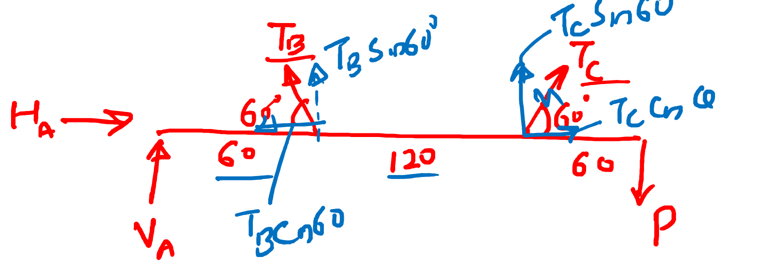
FBD of the brake arm ABCD

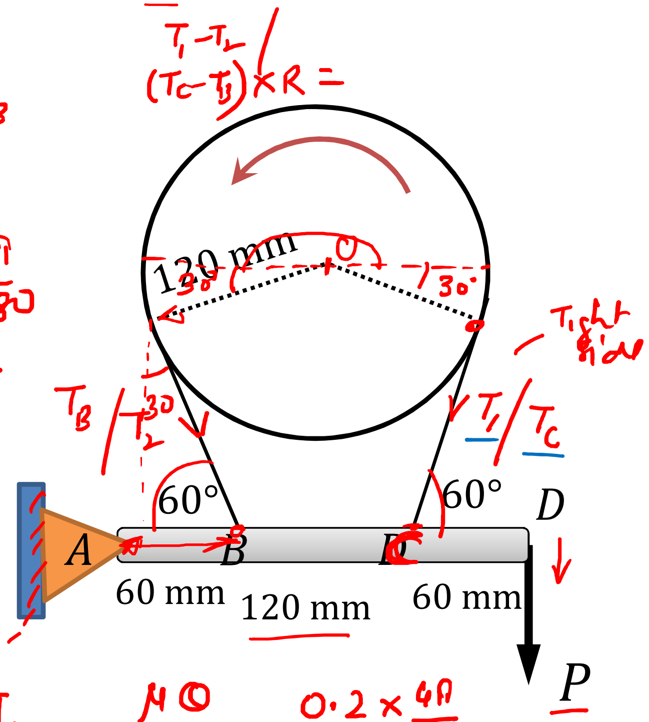


$T_c > T_B$

$(T_c - T_B) \times R =$

$T_1 - T_2$

$\theta = 240° = 240 \times \frac{\pi}{180} = \frac{4\pi}{3}$ rad.



$\Sigma M_A = 0$

$T_B \sin 60 \times 60 + T_c \sin 60 \times 180 - P \times 240 = 0$

$76.27 \times \sin 60 \times 60 + 176.18 \sin 60 \times 180 = 240P$

$$\boxed{P = 130.95\text{ N}}$$

$$\underbrace{(T_c - T_B) \times 120}_{\text{Torque}} = 12000$$

$T_c - T_B = 100\text{ N}$ — I

$2.31\, T_B - T_B = 100$

$T_B = 76.27\text{ N}$

$T_c = 2.31 \times 76.27 = 176.18\text{ N}$

$\frac{T_c}{T_B} = e^{\mu\theta} = e^{0.2 \times \frac{4\pi}{3}}$

$= 2.31$

$T_c = 2.31\, T_B$ — II

Put in eq I

THANK YOU