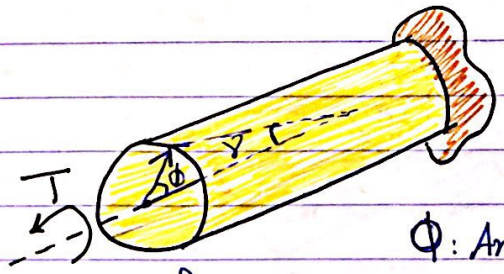
Chapter 5 : Torsion

$$\gamma = \frac{\rho}{c}\gamma_{max}$$



Max shear strain γ_{max} is at the Surface

ϕ: Angle of twist

Torsion formula:

τ_{max} : is at the surface

$$\tau = \frac{\rho}{c}\tau_{max}$$

$$\boxed{\tau = \frac{T \cdot \rho}{J}}$$

Special case:

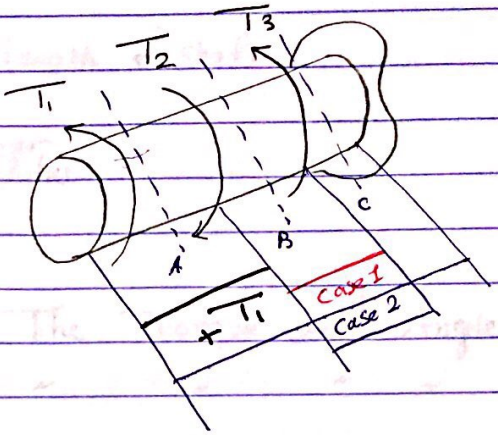
$$\boxed{\tau_{max} = \frac{T \cdot c}{J}}$$

J → Solid: $\frac{\pi}{2} c^4$

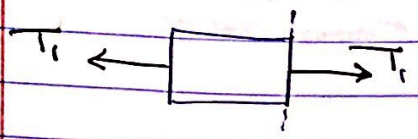
J → Tube: $\frac{\pi}{2}(c_o^4 - c_i^4)$

Torque Diagram :

① Take sections

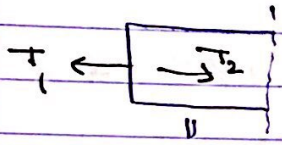


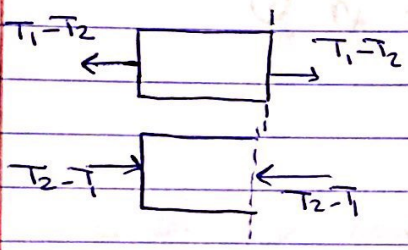
Sec A :-



Tension so +

Sec B



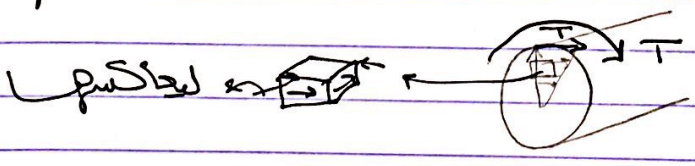


If $T_1 > T_2$ and so + Case 1

If $T_1 < T_2$ and so − Case 2

And same process for infinite number of Torques

▲ To determine Direction of shear stress on some pieces



Angle of Twist

$$\phi = \Sigma \frac{T L}{J G}$$

T: Torque, L: length of shaft, J: Polar moment, G: Shear Modulus

Thumb outward: The Torque and Angle are +
Thumb Inward: " " " " " −

- When there is 2 Gears Connected

$$\phi_A r_A = \phi_B r_B$$

- if you have two shafts

$$\phi_D = \phi_{D/B \text{ in the shaft}} + \phi_{\text{in Gear B}}$$

$$\phi_D = \phi_{D/B} + \phi_B$$