DIGITAL EDUCATION MARTCOST

# INTERMEDIATE

# Circular Motion

*Hand Notes For JEE Mains, Advance, NEET UG, Class 11 & 12 etc…*

## Hand Notes

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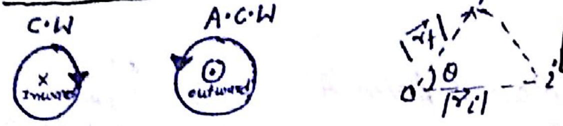
# CIRCULAR MOTION

## Basic term Related to Angular motion

|1| → Angular displacement ($\theta$) → Body Rotate w.r.t fixed point · Angle b/w Initial & Final position vector.

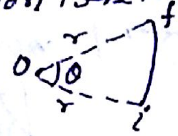
* When Magnitude of Initial & Final position vector is same.
* unit → Radian (R), Degree ($\theta$)
* Dimensionless.
* Small Angular displacement is a Axial vector & Its direction is define from Right hand thumb Rule.
* Large Angular displacement is scal quantity.

**NOTE** → * Axial vector → Vector which is along the Rotational axis.




$$|\vec{r_i}| = |\vec{r_f}|$$

* ⟹ Angular displacement in one Rotation is ⟹ $2\pi$.
* ⟹ 'N' Rotation ⟹ $2\pi N = \theta$




$$\text{Angle} = \frac{\text{Arc}}{\text{Radius}}$$

$$\theta = \frac{\text{Arc}}{r}$$

$$\text{Arc} = \theta r$$

|2| → Angular velocity ($\omega$) → * Rate of change In Angular disp. represent Angular velocity.

* It is also Axial vector & direction ∥ to the angular disp.

$$\vec{\omega} = \frac{\Delta\theta}{\Delta t}$$

* unit → R/sec

* $\vec{\omega} \parallel \vec{\theta}$

$$1 \text{ Rotation} \Rightarrow \omega = \frac{\Delta\theta}{\Delta t} = \frac{2\pi}{T} = 2\pi n$$

$\omega$ → Angular freq. or, velocity; $T$ → Time period; $n$ → Frequency [Hz, c.p.s, p.M, R.p.M]

### # Types of Angular velocity

|i| → uniform Angular velo
Direction + Magnitude same.

|ii| → Non-uniform Angular velocity
Direction change / Magnitude change / Both change.

|iii| → Inst. Angular velocity

$$\omega_t = \lim_{t \to 0} \frac{\Delta\theta}{\Delta t} = \frac{d\theta}{dt}$$

↳ Ist derivative of Angular disp.

|iv| → Avg. Angular velocity

$$\omega_{avg} = \frac{\text{Total Angular disp.}}{\text{total time}}$$

$$\vec{\omega}_{avg} = \frac{\vec{\theta_1} + \vec{\theta_2} + \vec{\theta_3} + \cdots + \vec{\theta_N}}{t_1 + t_2 + t_3 + \cdots + t_N}$$

### # Standard Result

|i| → Same time Interval.

$$\omega_{Avg} = \frac{\omega_1 + \omega_2 + \omega_3 + \cdots \omega_N}{N}$$

|ii| → Same Angular displacement.
$(\theta_1 = \theta_2 = \cdots = \theta_N)$

$$\omega_{avg} = \frac{N}{\frac{1}{\omega_1} + \frac{1}{\omega_2} + \frac{1}{\omega_3} + \cdots + \frac{1}{\omega_N}}$$

|iii| → $\theta = f(\text{time})$ ⟹ function of time ⟹ $\omega = \frac{d\theta}{dt} = f(t)$

$$\langle\omega\rangle = \omega_{avg} = \frac{\int_{T_1}^{T_2} \omega(t)\,dt}{\int_{T_1}^{T_2} dt}$$

* |iv| → $\omega = f(\theta)$

$$\langle\omega\rangle = \frac{\int_{\theta_1}^{\theta_2} \omega(\theta)\,d\theta}{\int_{\theta_1}^{\theta_2} d\theta}$$