Chapter-7 : [ROTATIONAL MECHANICS (घूर्णन यांत्रिकी)]

(a) Vector [VECTOR PRODUCT / CROSS PRODUCT]

(b) Motion in a straight + plane

(c) Newton's Laws of motion (NLM)

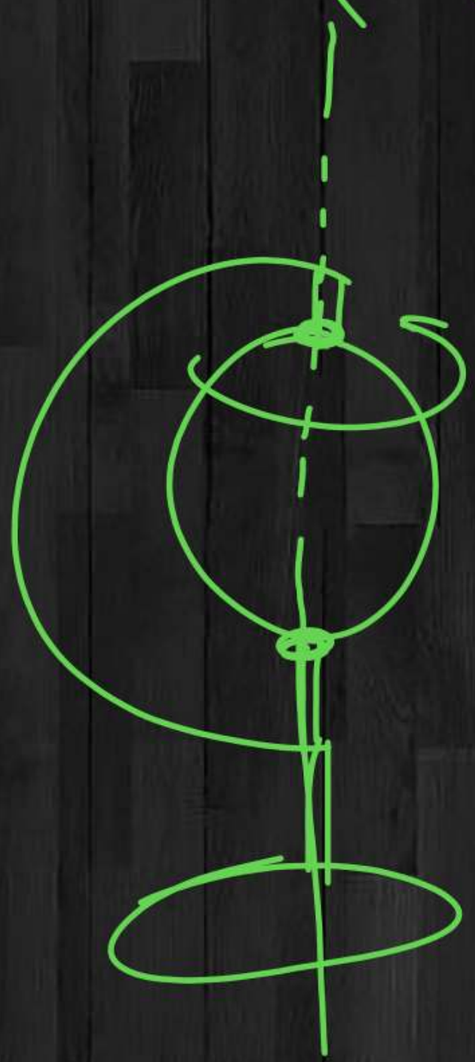
(d) friction (घर्षण) + Circular motion वृतीय गति

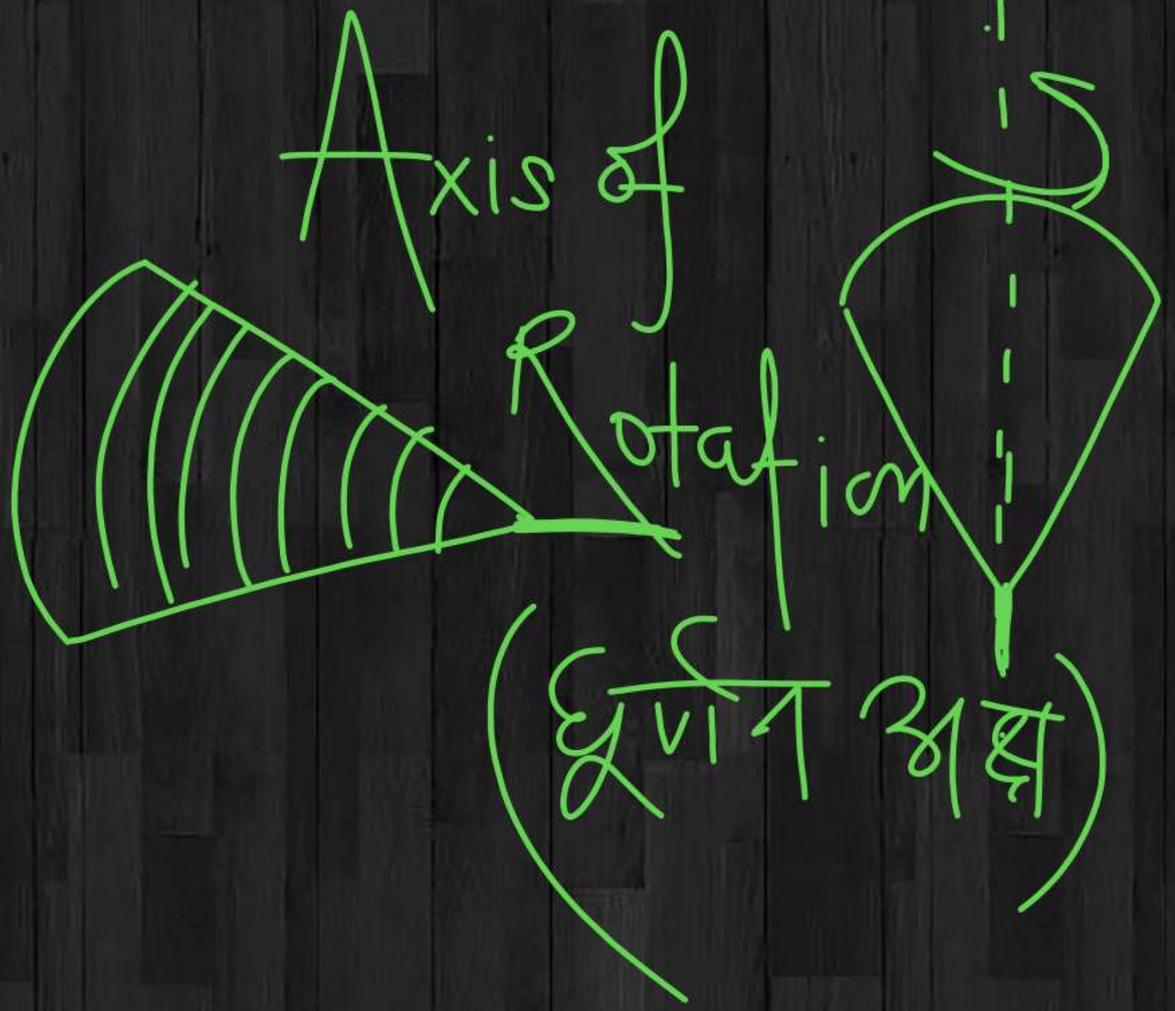
V.V.I

(e) Conservation of momentum
(संवेग का संरक्षण)

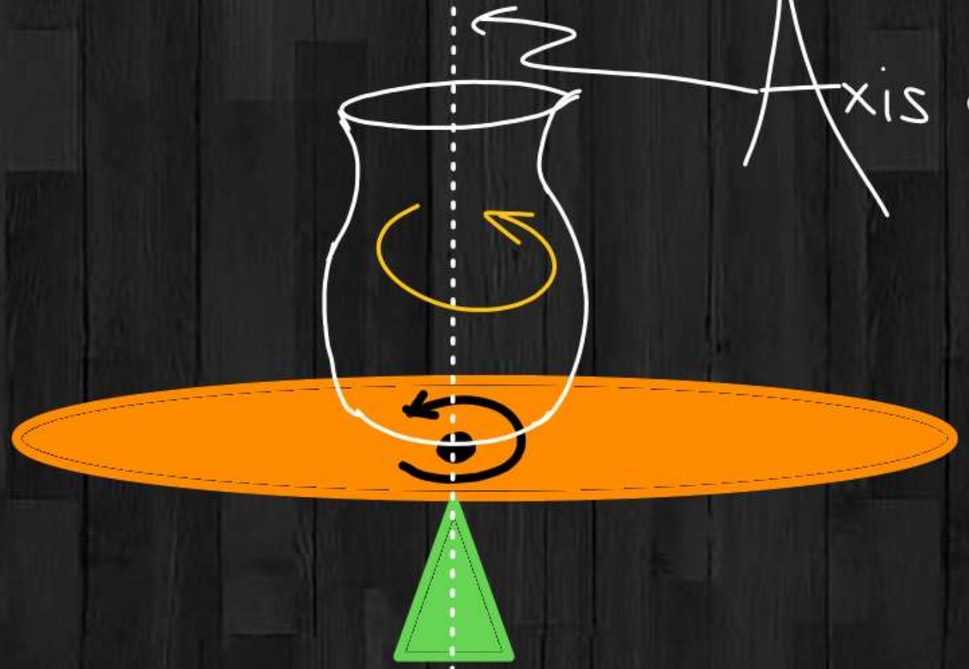
(f) Work = Energy & Power.
(कार्य ऊर्जा तथा शक्ति)

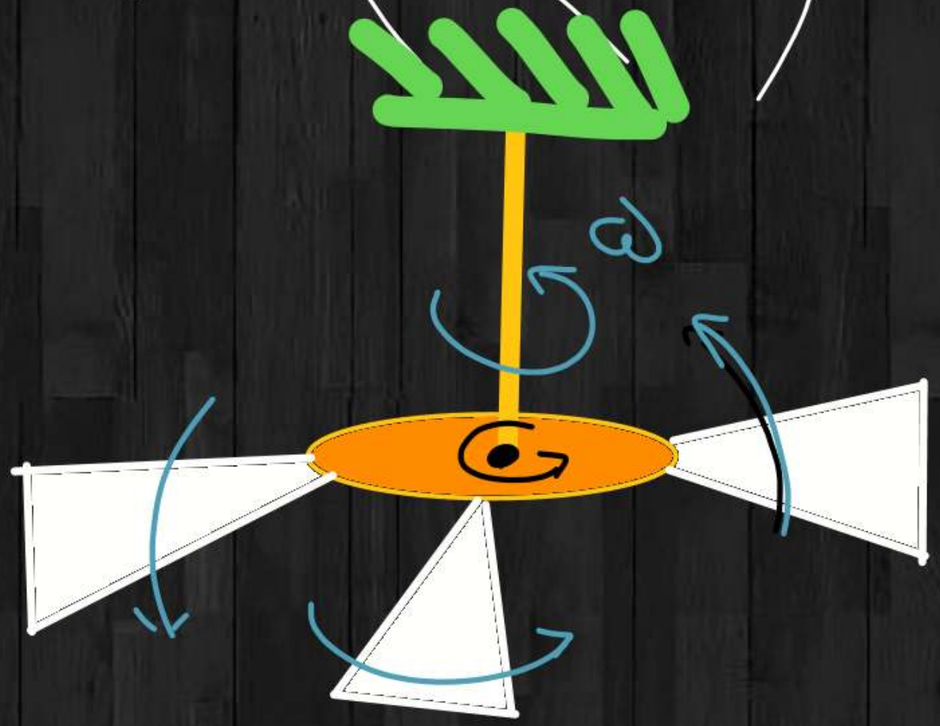
Introduction (परिचय) →





Axis of Rotation (घूर्णन अक्ष)





Centre of gravity (गुरुत्वीय केन्द्र)

+

(1) Centre of mass [द्रव्यमान केन्द्र]

(2) Moment of Inertia (जड़त्व आघूर्ण)

(3) Torque / Moment of force [बल आघूर्ण]

(4) Angular momentum and angular impulse
(कोणिय संवेग तथा आवेग)

(5) Newton's Second Law of motion
↓
* Conservation of angular momentum
कोणिय संवेग का संरक्षण
* Impulse-momentum theorem
आवेग संवेग प्रमेय

⑥ Rotational motion
(घूर्णन गति)

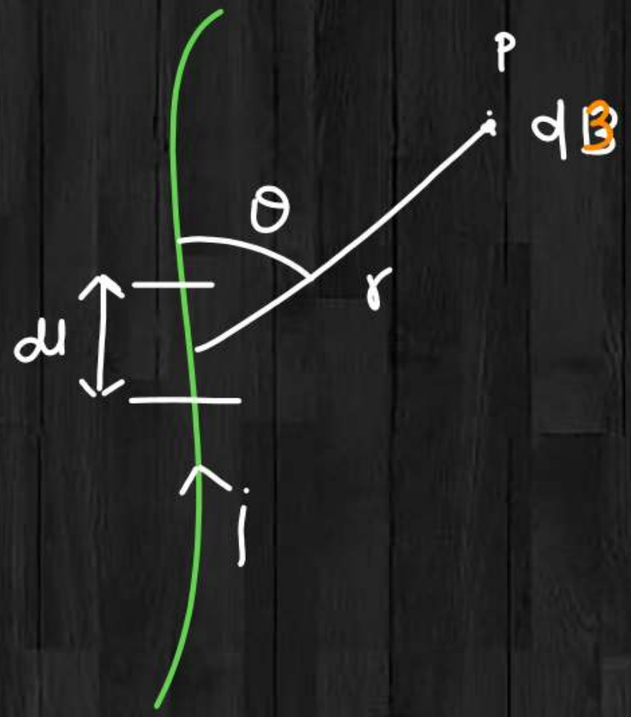
Pure Rotational Motion

Rolling Motion

CASES

Question

BIOT - SAVART LAW [बायोट-सार्वत का नियम]



$dB \propto i$

$dB \propto dl$

$dB \propto \sin\theta$

$dB \propto \frac{1}{r^2}$

$$dB \propto \frac{I\,dl\sin\theta}{r^2}$$

$$dB = \left(\frac{\mu_0}{4\pi}\right)\frac{I\,dl\sin\theta}{r^2}$$

$\frac{\mu_0}{4\pi}$ = नियतांक

$= 10^{-7}$ Tm/A $= 10^{-7}$ $\frac{H}{m}$

$\mu_0 = 4\pi \times 10^{-7}$ $\frac{H}{m}$

$= 4\pi \times 10^{-7}$ $\frac{Tm}{A}$ $\left[\frac{wb}{A \cdot m}\right]$

$= 4\pi \times 10^{-7}$ $\frac{J}{Am}$

$1T = \frac{N}{A \cdot m}$

Henry $= \frac{wb}{A} = \frac{Tm^2}{A} = \frac{N}{A \cdot m} \cdot m^2$

$H = \frac{Nm}{A} = \frac{J}{A} = \frac{wb}{A}$

$= \frac{Tm^2}{A}$

Vector form of Biot–Savart Law

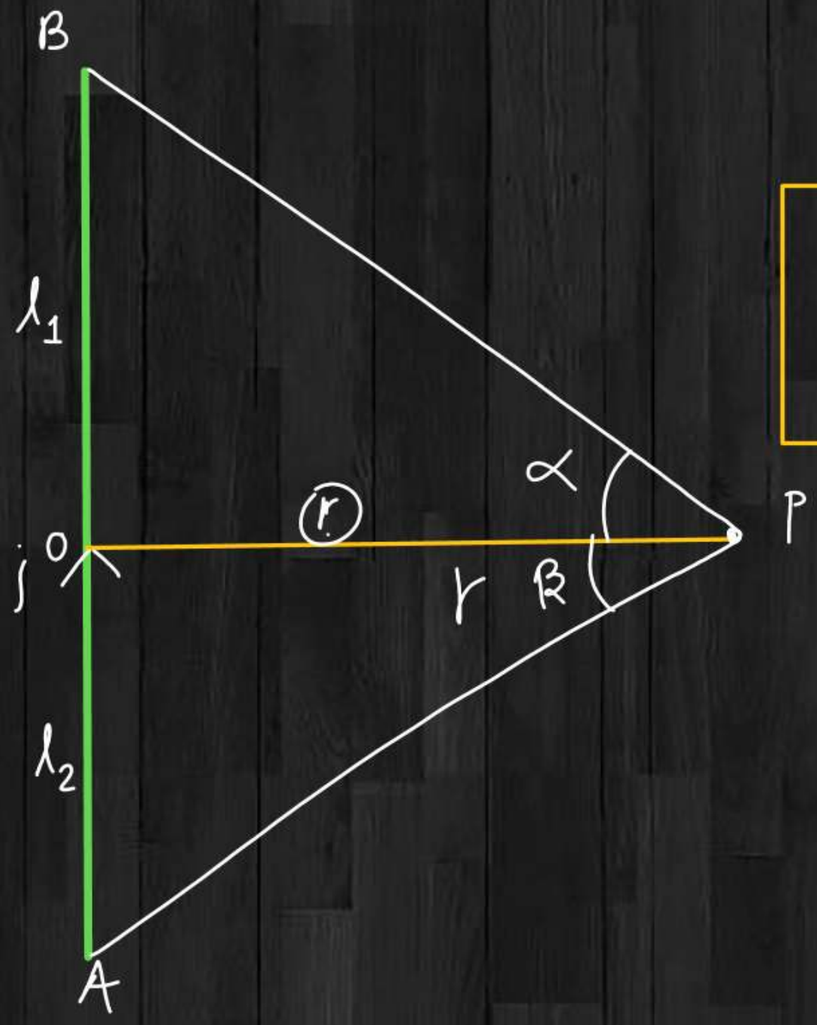
Biot-Savart का सदिश रूप : →

$$\vec{dB} = \frac{\mu_0}{4\pi} \frac{I(\vec{dl} \times \vec{r})}{|\vec{r}|^3}$$

$$\vec{dB} = \frac{\mu_0}{4\pi} \cdot \frac{I(\vec{dl} \times \vec{r})}{r^3}$$

Coulomb's law → Vector form : →

$$\vec{F} = \frac{1}{4\pi\epsilon_0} \cdot \frac{q_1 q_2}{|\vec{r}|^3} \cdot \vec{r} \rightarrow \vec{F} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{|\vec{r_2} - \vec{r_1}|^3} (\vec{r_2} - \vec{r_1})$$



$$B_P = \frac{\mu_0 i}{4\pi r}\left[\sin\alpha + \sin\beta\right]$$

Amper Circuital Law

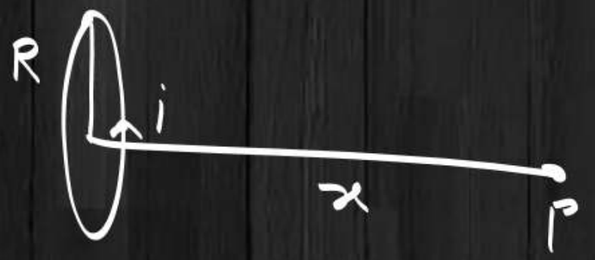
एम्पीयर परिपथीय नियम: →

$$\oint_1 \vec{B} \cdot \vec{dl} = \mu_0 i$$

किसी बन्द लूप में चुम्बकीय क्षेत्र का रैखीय समाकलन उससे प्रवाहित कुल धारा के μ_0 गुना के बराबर होता है।

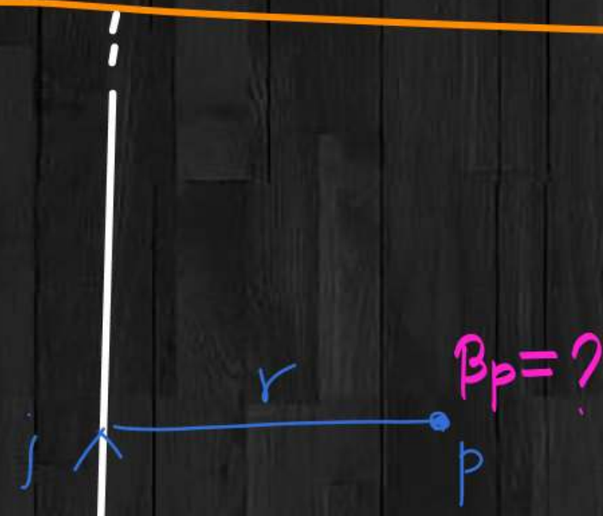
The line integral of magnetic field in a close loop is equal to the μ_0 times of current flow through it.

Application of ACL

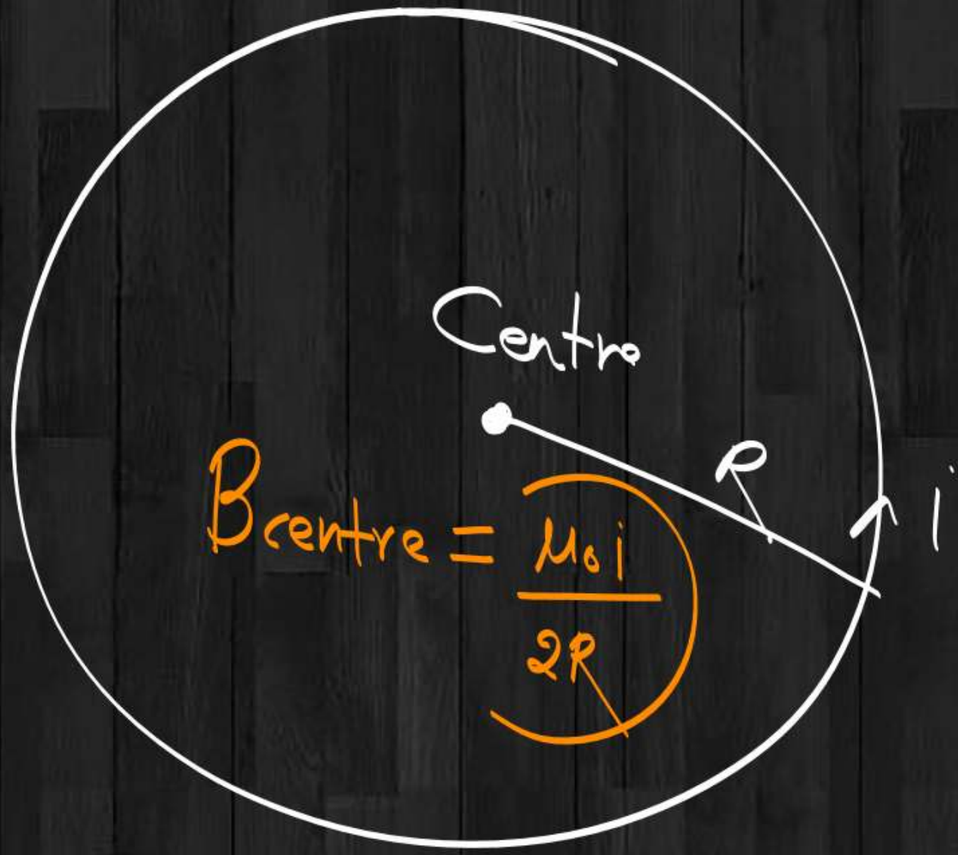


$$\left[B_P = \frac{\mu_0 i N R^2}{2(x^2+R^2)^{3/2}}\right]$$

(A) अनन्त लम्बाई वाले धारावाही चालक तार के कारण चुम्बकीय क्षेत्र (Magnetic field due to Current carrying long straight wire)



$$\boxed{B_P = \frac{\mu_0 i}{2\pi r}}$$


Centre
R
i
$B_{centre} = \frac{\mu_0 i}{2R}$