11^{th} Physics Unit - 3

Dynamics Of Rotational Motion

1] A **point** in the system at which **whole mass of the body** is supposed to be concentrated is called ***centre of mass*** .

2] **Rigid body** – The body which ***does not undergo any change in shape or volume when external forces are applied on it.***

3] When a **body rotates about a fixed axis**, its motion is known as **rotatory motion**.

4] A rigid body is said to have pure rotational motion, if every particle of the body moves in a circle, the centre of which lies on a straight line called the **axis of rotation**.

5] The **radius of gyration** is equal to the **root mean square distances of the particles from the axis of rotation of the body.**

6] **Parallel axes theorem -** The moment of inertia of a body about ***any axis is equal to the sum of its moment of inertia about a parallel axis through its centre of gravity and the product of the mass of the body and the square of the distance between the two axes.***

7] **Perpendicular axes theorem -** The moment of inertia of a plane laminar body about an ***axis perpendicular to the plane is equal to the sum of the moments of inertia about two mutually perpendicular axes in the plane of the lamina such that the three mutually perpendicular axes have a common point of intersection.***

8] The **magnitude of the moment of force** F about as point is defined as ***the product of the magnitude of force and the perpendicular distance of the point from the line of action of the force.***

9] ***Two equal and opposite forces*** whose lines of action do not coincide are said to ***constitute a couple*** **in mechanics.**

10] **The product of the forces forming the couple and the arm of the couple** is called the ***moment of the couple or torque***.

11] The **angular momentum** of a particle is defined as the ***moment of linear momentum*** of the particle.

12] Stable equilibrium – State in which a body tends to return to its original position after being disturbed.

13] Unstable equilibrium – State os equilibrium in which a small disturbance will produce a large change.

IMPORTANT TABLE

Body	Axis of Rotation	Moment of Inertia	
Thin Uniform Rod	Axis passing through its centre of gravity and perpendicular to its length	$\frac{Ml^2}{12}$	M - mass l - length
	Axis passing through the end and perpendicular to its length.	$\frac{Ml^2}{3}$	M - mass l - length
Thin Circular Ring	Axis passing through its centre and perpendicular to its plane.	MR^2	M - mass R - radius
	Axis passing through its diameter	$\frac{1}{2}MR^2$	M - mass R - radius
	Axis passing through a tangent	$\frac{3}{2}MR^2$	M - mass R - radius
Circular Disc	Axis passing through its centre and perpendicular to its plane.	$\frac{1}{2}MR^2$	M - mass R - radius
	Axis passing through its diameter	$\frac{1}{4}MR^2$	M - mass R - radius

	Axis passing through a tangent	$\frac{5}{4} MR^2$	M - mass R - radius
Solid Sphere	Axis passing through its diameter	$\frac{2}{5} MR^2$	M - mass R - radius
	Axis passing through a tangent	$\frac{7}{5} MR^2$	M - mass R - radius
Solid Cylinder	Its own axis	$\frac{1}{2} MR^2$	M - mass R - radius
	Axis passing through its centre and perpedicular to its length	$M\left(\frac{R^2}{4}+\frac{l^2}{12}\right)$	M - mass R - radius l - length