Date : / /
Page No.

Section → 4

Q1 Ans :→

Principle of Equilibrium :-

The principle of eq. states that, a stationary body which is subjected to coplanar forces (concurrent or not) will be in equilibrium, if the algebraic sum of all external forces is "Zero" & also the algebraic sum of moments of all the external forces about any pt. in their plane is "Zero".

$$\sum F = 0$$
$$\sum M = 0$$

⇒ The eq. is also known as force law of equilibrium whereas the eq^n is known as moment law of equilibrium.

⇒ The forces are generally resolved into horizontal & vertical components. Hence,

$$\sum F_x = 0 \quad \& \quad \sum F_y = 0$$

Where

$\sum F_x$ → Algebraic sum of all horizontal components

$\sum F_y$ → " " " " vertical components

Date : / /
Page No.

The eqⁿ. of equilibrium for coplanar, non-concurrent force system :-

- A non-concurrent force system will be in equilibrium if the resultant of all forces & moment is zero.

- Hence the eqⁿ. of equilibrium :-

$$\Sigma f_x = 0 \quad , \Sigma f_y = 0 \text{ \& } \Sigma M = 0$$

Eqⁿ. of equilibrium for coplanar, concurrent force system :-

- For the concurrent force, the lines of action of all forces meet at point, & hence the moment of those forces about that point will be zero $\therefore$ $\Sigma M = 0$ automatically.

- Thus for concurrent force system, the condition $\Sigma M = 0$ becomes redundant & only two conditions, i.e. $\Sigma f_x = 0$ & $\Sigma f_y = 0$ are required.

Page No.
Date

Equilibrium of system of Forces :-

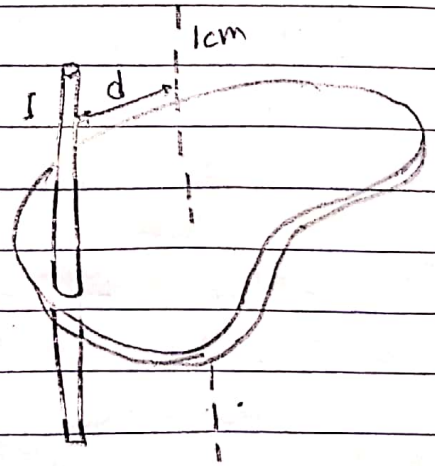
- When some external forces act on a body but it does not start moving and also does not start rotating about any point, then the body is said to be in equilibrium.

Parallel axis theorem :-

The moment of inertia of any object about an axis through its centre of mass is the min. moment of inertia for an axis through the centre of mass is given by :-

$$I_{\text{Parallel axis}} = I_{cm} + Md^2$$

- The expression added to the centre of mass moment of inertia will be recognized as the moment of inertia of point mass.



Page No.
Date

- The moment of inertia about a parallel axis is the centre of mass moment plus the moment of inertia of the entire object treated as a point mass at the centre of mass.

⇒ Shear force	Bending Moment
• When two equal & opp. forces having different lines of action applied to a body, tend to cause angular distortion in the body the force applied is known as shear force.	• A bending moment is the reaction induced in a structured element when an external when an external force moment is applied to the element causing the element to bend.