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MECHANICS
SUB. CODE-BSPH1102
For B.Sc.(Physics & Chemistry)
Rotational Dynamics)

Calculation of moment of inertia for spherical bodies

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MI of spherical shell about its diameter

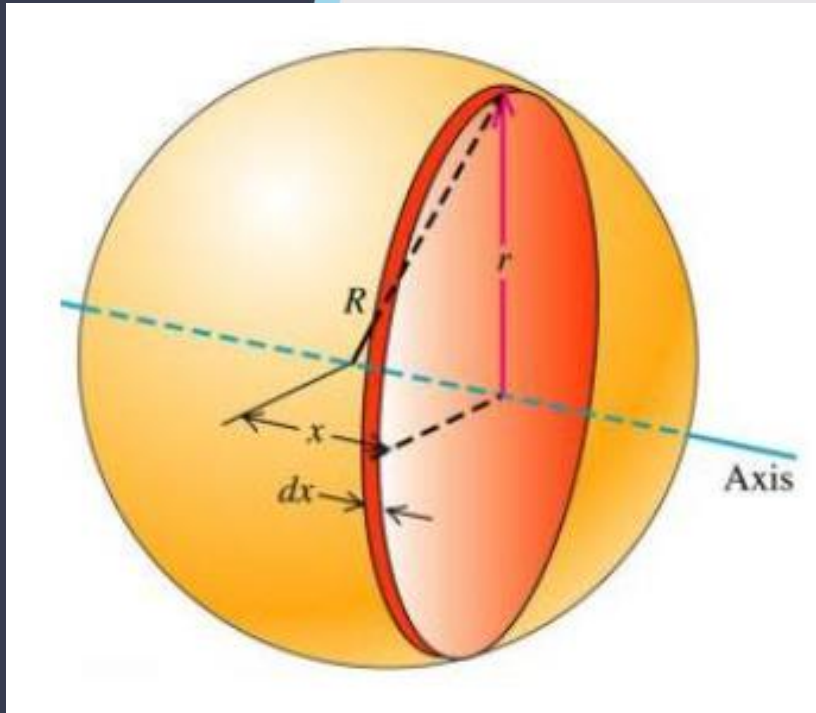
A thin uniform spherical shell has a radius of R and mass M . Calculate its moment of inertia about any axis through its centre.

mass/area = $\sigma = \frac{M}{4\pi R^2}$, the
thickness of elementary slice = dx

Width of the ring = $Rd\theta$

Radius of the ring = $R \cos \theta$

Area of the elementary
ring = circumference * width =
 $2\pi R \cos \theta \times Rd\theta$





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$$\text{Mass of the ring} = 2\pi R \cos \theta \times R d\theta \times \frac{M}{4\pi R^2} = M \cos \theta d\theta / 2$$

$$x = R \sin \theta$$

$$dx = R \cos \theta d\theta$$

$$\text{So, Mass of the ring} = \frac{M dx}{2R}$$

$$\text{Hence, } dI = \text{mass} \times \text{radius}^2 = \frac{M dx}{2R} \times (R^2 - x^2)$$

$$I = \frac{2}{3} MR^2$$



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Reference

Mechanics by *D. S. Mathur*, S. Chand, chp-11.8 to 11.9

