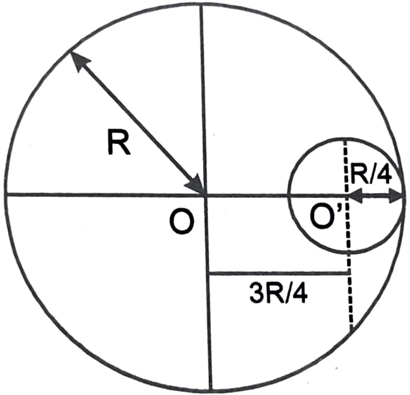
A circular hole of radius $\frac{R}{4}$ is made in a thin uniform disc having mass M and radius R, as shown in figure. The moment of inertia of the remaining portion of the disc about an axis passing through the point O and perpendicular to the plane of the disc is : **[JEE MAIN (Online) 2017]**



(A) $\frac{219MR^2}{256}$ (B) $\frac{197MR^2}{256}$ (C) $\frac{19MR^2}{512}$ (D) $\frac{237MR^2}{512}$

Let the mass per unit area of disc be σ
Now, moment of inertia of removed mass

$$(M_2) = \left(\frac{(\sigma A')\left(\frac{R}{4}\right)^2}{2} + (\sigma A')\left(\frac{3R}{4}\right)^2\right)$$

Using parallel axis theorem

$$M_2 = (\sigma A')\left(\frac{R^2}{32} + \frac{9R^2}{16}\right)$$

$$A' = \pi\left(\frac{R}{4}\right)^2 = \frac{\pi R^2}{16}$$

$$M_2 = \left(\frac{\sigma\pi R^4}{16}\right)\left(\frac{19}{32}\right)$$

Also, moment of inertia of complete disc is:

$$\Rightarrow M_1 = \left(\frac{(\sigma A) \times R^2}{2}\right)$$

Effect moment of inertia = $M_1 - M_2$

$$M_0 = \frac{\sigma}{2}\pi R^4 - \frac{\sigma\pi R^4.19}{512}$$

$$M_0 = (\sigma\pi R^2).R^2.\frac{237}{512}$$

$$\sigma\pi R^2 = M$$

$$M_0 = \frac{237}{512}MR^2$$