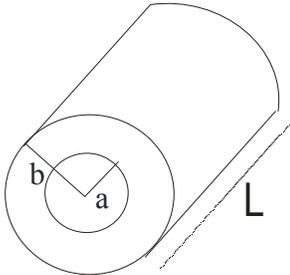


Rotation Assignment 2

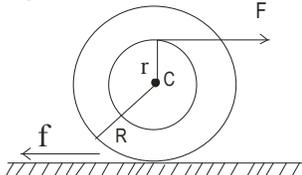
Question 1- A uniform hollow cylinder has a density ρ , a length L , an inner radius a , and outer radius b . Show that its moment of inertia about the axis of cylinder

is $I = \frac{1}{2} \pi \rho L (b^4 - a^4) = \frac{1}{2} M (b^2 + a^2)$, where M is the mass of the cylinder.



Question 2- Starting from rest, a sphere rolls down a 30° incline. What is the minimum value of coefficient of static friction if there is to be no slipping?

Question 3- A spool of mass M is resting on a horizontal surface. The spool has moment of inertia MG^2_c about its axis of symmetry. The spool is subjected to the rightward horizontal force of magnitude F , applied at a distance r above the axis.



(a) Show if there is no slippage between spools and surrounding surface, a leftward frictional force $f = \frac{F(G^2_c - rR)}{(G^2_c + R^2)}$ must act on the spool (b) Show that the required fractional force f has the value zero for the particular r_0 of the distance r .

Question 4- A circular disc of mass M and radius R revolves about its own axis with angular velocity ω

Find out following

- Moment of Inertia about its own axis
- Kinetic energy of rotation
- Angular momentum of the disc about its own axis
- If a another disc of mass M and radius R is placed on this disk such that axis of rotation is along the same line, what will be the final angular velocity of the system

Question 5- A rod of length L and Mass M lies on a frictionless horizontal table. It is free to move in any way on the table. A small body of mass m moving with a velocity u collides in elastically with the rod .

- Find the velocity of the centre of mass of the rod
- Find the angular velocity of the rod about centre of mass

Question 6-

A uniform disc of Radius R and mass M is spinned to the angular velocity ω_0 and then it is placed on a horizontal surface. The coefficient of friction between the disc and surface is μ . The pressure exerted by the disc on the surface can be regarded as uniform

- a) Find the moment of inertia of the disc about the rotating axis
- b) Find the angular deceleration of the disc
- c) Find the time in which disc will come to rest
- d) The kinetic energy of the disc t sec after the disc is placed on the surface

Question 7-

A uniform thin bar of mass M kg and length L is bent to make a square. Calculate its moment of inertia about an axis passing through the centre of mass and perpendicular to the plane of square