PHYSICS

BOOKS - VGS BRILLIANT PHYSICS (TELUGU ENGLISH)

SYSTEM OF PARTICLES AND ROTATIONAL MOTION

Very Short Answer Questions

1. Is it necessary that a mass should be present at the centre of mass of any system ?

View Text Solution

2. What is the difference in the positions of a girl carrying a bag in one of her hands and another girl carrying a bag in each of her two hands?

Watch Video Solution

3. Two rigid bodies have same moment of inertia about their axes of symmetry. Of the two, which body will have greater kinetic energy?

Watch Video Solution

4. Why are spokes provided in a bicycle wheel ?

Watch Video Solution

5. We cannot open or close the door by applying force at the hinges. Why?

Watch Video Solution

6. Why do we prefer a spanner of longer arm as compared to the spanner of shorter arm?

Watch Video Solution

7. By spinning eggs on a table top, how will you distinguish an hard boiled egg from a raw egg?

Watch Video Solution

8. Why should a helicopter necessarily have two propellers ?

Watch Video Solution

9. If the polar ice caps of the earth were to melt, what would the effect of the length of the day be?

Watch Video Solution

10. Why is it easier to balance a bicycle in motion ?

Watch Video Solution

Short Answer Questions

1. Distinguish between centre of mass and centre of gravity .

Watch Video Solution

2. Show that a system of particles moving under the influence of an external force, moves as if the force is applied at its centre of mass.

Watch Video Solution

3. Explain about the centre of mass of earth moon system and its rotation around the sun.

View Text Solution

4. Define vector product. Explain the properties of a vector product with two examples.

Watch Video Solution

5. Define angulnr velocity. Derive $v = r\omega$

Watch Video Solution

6. State the principle of conservation of angular momentum. Give two examples.

Watch Video Solution

7. Define angular acceleration and torque. Establish the relation between angular

acceleration and torque.

Watch Video Solution

8. Write the equations of motion for a particle rotating about a fixed axis.

Watch Video Solution

9. Derive expressions for the final velocity and total energy of a body rolling without slipping.

Watch Video Solution

Long Answer Questions

1. State and prove parallel axis theorem.

View Text Solution

2. For a thin flat circular disk, the radius of gyration about a diameter as axis is k. If the disk is cut along a diameter AB as shown into two equal pieces, then find the radius of

gyration of each piece about AB.

View Text Solution

3. State and prove perpendicular axis theorem

Watch Video Solution

4. If a thin circular ring and a thin flat circular disk of same mass have same moment of

inertia about their respective diameters as axis. Then find the ratio of their radii.

Watch Video Solution

5. State and prove the principle of conservation of angular momentum. Explain the principle of conservation of angular momentum with examples.

View Text Solution

Problems

1. Show that $a.\ (b \times c)$ is equal in magnitude to the volume of the parallelopiped formed on the three vectors a, b and c.

View Text Solution

2. A rope of negligible mass is wound round a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force of 30

N. ? What is the linear acceleration of the rope ? Assume that there is no slipping.

Watch Video Solution

3. A coin is kept a distance of 10 cm from the centre of a circular turn table. If the coefficient of static friction between the table and the coin is 0.8. Find the frequency or rotation of the disc at which the coin will just begin to slip

Watch Video Solution

4. Find the torque of a force $7\vec{i} + 3\vec{j} - 5\vec{k}$ about the origin. The force acts on a particle whose position vector is $\vec{i} - \vec{i} + \vec{k}$.

Watch Video Solution

5. Particles of masses 1g, 28, 3g ..., 100g are kept at the marks 1 cm, 2 cm, 3 cm ... , 100 cm respectively on a meter scale. Find the moment of inertia of the system of particles

about a perpendicular bisector of the meter scale.

View Text Solution

6. Calculate the moment of inertia of a fly wheel, if its angular velocity is increased from 60 r.p.m. to 180 r.p.m. when 100 J of work is done on it.

Watch Video Solution

7. Three particles each of mass 100 g are placed at the vertices of an equilateral triangle of side length 10 cm. Find the moment of inertia of the system about an axis passing through the centroid of the triangle and perpendicular to its plane.

Watch Video Solution

8. Four particles each of mass 100g are placed at the corners of a square of side 10 cm. Find

the moment of inertia of the system about an axis passing through the centre of the square and perpendicular to its plane. Find also the radius of gyration of the system.

Watch Video Solution

9. Two uniform circular discs, each of mass 1 kg and radius 20 cm, are kept in contact about the tangent passing through the point of contact. Find the moment of inertia of the

system about the tangent passing through the point of contact.

Watch Video Solution

10. Four spheres each diameter 2a and mass 'm' are placed with their centres on the four corners of a square of the side b. Calculate the moment of inertia of the system about any side of the square.

Watch Video Solution

11. To maintain a rotor at a uniform angular speed or 200 rad s^{-1} an engine needs to transmit a torque of 180 Nm. What is the power required by the engine ? (Note : uniform angular velocity in the absence of friction implies zero torque. In practice, applied torque is needed to counter frictional torque). Assume that the engine is 100% efficient.

Watch Video Solution

12. A metre stick is balanced on a knife edge at its centre. When two coins, each of mass 5g are put one on top of the other at the 12.0 cm mark, the stick is found to be balanced at 45.0 cm. What is the mass of the metre stick?

Watch Video Solution

13. Determine the kinetic energy of a circular disc rotating with a speed of 60 rpm about an axis passing through a point on its

circumference and perpendicular to its plane. The circular disc has a mass of 5 kg and radius 1 m.

Watch Video Solution

14. Two particles, each of mass m and speed u, travel in opposite directions along parallel lines separated by a distance d. Show that the vector angular momentum of the two particle system is the same whatever be the point about which the angular momentum is taken.

View Text Solution

15. The moment of inertia of a flywheel making 300 revolutions per minute is 0.3 kgm^2 . Find the torque required to bring it to rest in 20s.

Watch Video Solution

16. Calculate the moment of inertia of a fly wheel, if its angular velocity is increased from 60 r.p.m. to 180 r.p.m. when 100 J of work is done on it.

Watch Video Solution

17. Find the centre of mass of three particles at the vertices of an equilateral triangle. The masses of the particles are 100g, 150g and 200g respectively. Each side of the equilateral triangle is 0.5 m long, 100g mass is at origin and 150g mass is on the X-axis.

Watch Video Solution