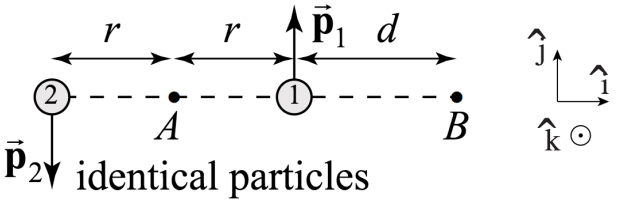
ASSIGNMENT - 7

PH1101: Mechanics-I

Last date: 23:00 hrs, April 10, 2022 Maximum Marks: 100

1. Derive the solutions of the harmonic oscillator and prove that the total energy of the harmonic oscillator constant [10]

2. Two identical particles form a system, at the instant shown in the below figure the particles have equal and opposite momentums ($p_1 = -p_2 = p$). Determine a vector expression for the angular momentum of the system about the point A, B and compare?



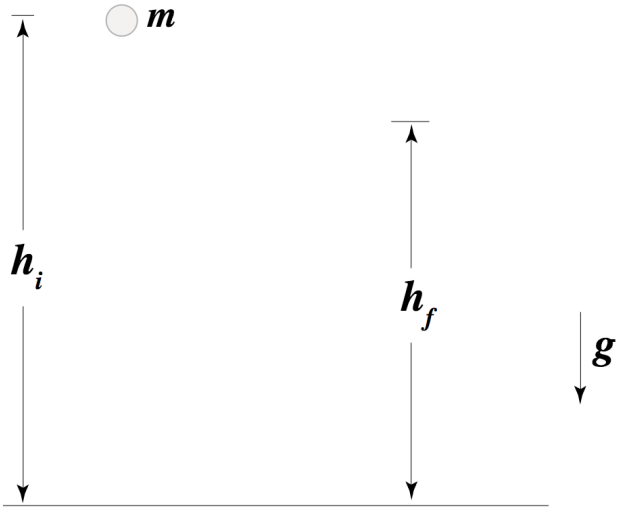
[10]

3. Derive the parallel axis theorem for a rotational motion and verify? [10]

4. Derive the potential energy of of gravity near the surface of the earth? [10]

5. Derive the work done by the conservative and non-conservative forces? [10]

6. A ball of mass m is released from rest from a height h_i above a horizontal surface. It hits the surface and bounces off vertically to reach a maximum height h_f. The ball is in contact with the table for a time T. Calculate N_{avg}, the magnitude of the time average normal force exerted by the table on the ball.



[10]

7. A person on a spherical asteroid of mass m_1 and radius R, sees a small satellite of mass m_2 orbiting the asteroid in a circular orbit of period T. What is the radius r_{sat} of the satellite's orbit? [10]

8. The center of two spherical planets of masses m_1 and m_2 are separated by a distance d. Consider the origin of the coordinate system to be at the center of planet 1. At what location x measured from the center of planet 1 will a third planet of mass experience zero gravitational force? Assume $m_1 \neq m_2$.

[10]

9. Derive and discuss the velocity and the acceleration in Polar Coordinates? [10]

10. Show that the Polar curve C : $r = 2(\cos\theta - \sin\theta)$ represents a circle. Find its radius and cartesian coordinates of its centre? [10]
