ASSIGNMENT - 8
PH1101: Mechanics-I

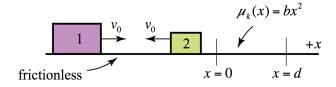Last date: 23:00 hrs, April 10, 2022 $\hphantom{xxxxxxxxxxxxxxxxxxxx}$ Maximum Marks: 100

1. Derive the solutions of the damped harmonic oscillator and prove that the total energy of the damped harmonic oscillator is dissipating? [10]

2. Prove that if the total momentum of a system is zero then the angular momentum is independent of position? [10]

3. Derive the rotational equation of motion? [10]

4. Derive the potential energy of spring and plot? [10]

5. Block 1 of mass $3m$ is sliding along a frictionless horizontal table to the right with speed v_0. Block 1 collides with block 2 of mass m that is moving to the left with speed v_0. After the collision, the two blocks stick together and the blocks enter a rough surface at $x = 0$ with a coefficient of kinetic friction that increases with distance as $\mu(x) = bx^2$ for $0 \le x \le d$ for , where b is a positive constant. The blocks come to rest at $x = d$. The downward gravitational acceleration has magnitude (g). Determine an expression for the initial speed v_0 of the blocks.

[10]

6. Calculate the center of mass of a continuous system? [10]

7. If an object of mass m having a 1D motion, find out all contact forces acting on the object? [10]

8. Define inertial and non-inertial frames of reference?. [10]

9. Expand function $f(x)$ as a power series in x and evaluate using Taylor series?. [10]

10. Derive the kinematical equations of velocity and position. [10]