# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI - 600034 

## B.Sc. DEGREE EXAMINATION - PHYSICS

SECOND SEMESTER - APRIL 2022
UPH 2501 - MECHANICS

Date: 16-06-2022 $\square$

## PART - A

(10x $2=20$ Marks)
Q. No

## Answer ALL questions

1 State Newton's first law of motion
2 What are conservative and non-conservative forces?
3 What are the salient properties of simple harmonic motion?
4 Write a short note on time dilation.
5 What is central force?
6 Prove that Kepler's second law is a consequence of conservation of angular momentum.
7 Define "center of mass".
8 What is small angle approximation?
9 A hollow sphere and solid sphere having the same mass are rolling on the inclined plane without slipping. Which one will reach the ground first? Why?

10 Write the postulates of special theory of relativity.

PART - B
(4 x $7.5=30$ Marks)
Answer any FOUR questions
(a) Show that the trajectory of the projectile motion is parabola
(b) For what angle of projection, the range is maximum? Show the calculation.

12 State and prove (a) perpendicular axis theorem for a plane lamina (b) parallel axis theorem
(a) Calculate the escape velocity of the particle from the surface of earth.
(b) Derive the potential energy expression for two masses separated by finite distance.

14 Derive Lorentz transformation equations.
15 Derive the expression for time period of compound pendulum.
16 Explain in detail length contraction and time dilation.

## Part C

## Answer any FOUR questions

17 Discuss the motion of a particle of charge ' $q$ ', mass ' $m$ ' and velocity ' $v$ ' in a magnetic field of intensity ' $B$ ' if $v$ makes an angle $\theta$ with magnetic field $B$.

18 Set up and solve Newton's equation for simple pendulum in two different methods.
(a) Describe in detail, the analysis of potential energy curve $U(x)$.
(b) Set up and solve Newton's equation for Atwood machine problem. Describe Michelson-Morley experiment and discuss the implications of the negative result. Consider rolling down an incline of an object with a circular periphery and mass distribution symmetric about its center. Find the translational acceleration of rigid body by two different methods.

22 Let a particle of Mass $\mathrm{m}_{1}$ is moving with velocity $\vec{v}_{1}$ (along x direction) and another particle of mass $m_{2}$ is at rest. The mass $m_{1}$ collide with mass $m_{2}$ and both the masses stick together and moves with final speed $\vec{v}$ (along $x$ direction). Describe the motion before and after the collision with respect to center of mass frame.

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