



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

**B.Sc. DEGREE EXAMINATION – PHYSICS**

**SECOND SEMESTER – APRIL 2022**

**16/17/18UPH2MC01 – MECHANICS**

Date: 16-06-2022

Dept. No.

Max. : 100 Marks

Time: 01:00-04:00

**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 x7.5 = 30 Marks)**

Answer any **FOUR** questions

- 11 (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 (b) parallel axis theorem for a plane lamina.
- 13 (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

(4x12.5=50)

- 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.
- 19
  - (a) State and prove Kepler's laws of planetary motion.
  - (b) Set up and solve Newton's equation for Atwood machine problem.
- 20 Describe Michelson-Morley experiment and discuss the implications of the negative result.
- 21 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  $m_1$  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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