



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

SECOND SEMESTER – APRIL 2023

UPH 2501 – MECHANICS

Date: 29-04-2023

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

PART – A

(10 x 2 = 20 Marks)

Q. No.

Answer ALL questions

- 1 State Newton's second law of motion.
- 2 State the law of conservation of linear momentum.
- 3 Write any two properties of conservative forces.
- 4 What is an impulsive force?
- 5 Under what conditions, the torque on a body become zero?
- 6 The angular momentum of a body is 31.4 Js and its rate of revolution is 10 cycles per second. Calculate the moment of inertia of the body about the axis of rotation.
- 7 What is small angle approximation in simple harmonic motion?
- 8 Write the second order differential equation of motion of a damped harmonic oscillator.
- 9 What are the postulates of special theory of relativity?
- 10 Write the Lorentz transformation equations.

PART – B

(4 x 7.5 = 30 Marks)

Answer any FOUR questions

- 11 Describe the motion of a charged particle entering a uniform electric field with a velocity perpendicular to the field.
- 12 Show that the work done by the force acting on a free particle is equal to the change in its kinetic energy.
- 13 Derive an expression for the rotational kinetic energy of a rigid body about a fixed axis.
- 14 Derive an expression for the time period of a simple pendulum using torque method.
- 15 Derive the relativistic velocity transformation equations.
- 16 Write short notes on length contraction and time dilation.

PART – C

(4 x 12.5 = 50 Marks)

Answer any FOUR questions

- 17 Two unequal masses m_1 and m_2 are suspended by a string passing over a frictionless pulley of negligible mass. Let m_1 be greater than m_2 .
 - a) What is the magnitude of acceleration experienced by each mass?
 - b) What is the tension T acting in the string?
 - c) If two masses are equal, what is the acceleration?

(5 +5+2.5)

- 18 What are electric and gravitational potentials? Deduce an expression for the potential of an object in a) gravitational field b) electric field.
(2.5+5+5)
- 19 a) State and prove the parallel axes of moment of inertia.
b) Derive the moment of inertia of a thin circular disc of mass M and radius R about an axis perpendicular to its plane and passing through its center of mass. Apply the perpendicular axis theorem to get the moment of inertia about one of its diameter.
(6+6.5)
- 20 Prove that the acceleration of the center of mass of a solid cylinder rolling without slipping down an inclined plane is $(2/3)g \sin \theta$.
- 21 a) Calculate the average kinetic energy and potential energy for a simple harmonic oscillator.
b) Show that the velocity of damping decreases exponentially with time.
(6.5+6)
- 22 Describe the Michelson-Morley's experiment with neat diagram.

\$\$\$\$\$\$