

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Sc. DEGREE EXAMINATION – PHYSICS

SECOND SEMESTER – APRIL 2018

17/16UPH2MC01– MECHANICS

Date: 24-04-2018

Dept. No.

Max. : 100 Marks

Time: 01:00-04:00

Part – A

Answer ALL Questions

(10 x 2 = 20 marks)

1. State Newton's first law of motion.
2. What is friction? Define co-efficient of friction.
3. What are conservative and non-conservative forces?
4. Define electric potential and give its unit.
5. What is equation of motion?
6. Define torque. What will happen when torque acting on a rotating body becomes zero?
7. What are the salient properties of simple harmonic motion?
8. How do we define the position of stable equilibrium?
9. What is relativistic aberration of light?
10. A rod 1 m long is moving along its length with a velocity of $0.6c$. Calculate its length as it appears to an observer (a) on the earth and (b) moving with the rod itself.

Part – B

Answer ANY FOUR Questions

(4 x 7.5 = 30 marks)

11. 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 θ with B.
12. (a) State and prove work-energy theorem for a particle. **(5)**
(b) A force, $F = (10 + 0.50x)$ acts on a particle in the x direction, where F is in newton and x in meter. Find the work done by this force during a displacement from $x = 0$ to $x = 2.0$ m. **(2.5)**
13. State and prove (a) perpendicular axes theorem for a plane lamina **(3.5)**
(b) parallel axes theorem **(4)**
14. (a) Determine the period of oscillation of a compound pendulum. **(6)**

(b) Also show that the centre of suspension and centre of oscillation are interchangeable.

(1.5)

15. Derive Lorentz transformation equations.

16. (a) A bomber flies along a horizontal line at an altitude of 490 m with a velocity of 100ms^{-1} . Find at what horizontal distance before passing over a target on the ground, a bomb should be dropped so as to hit the target. (3)

(b) A gun fires a bullet with a velocity of 200ms^{-1} at an angle of 40° with the ground. Find the velocity and position of the bullet after 20s. Also find the range and the time required for the bullet to return to ground. (4.5)

Part – C

Answer ANY FOUR Questions

(4 x 12.5 = 50 marks)

17. (a) Discuss the general motion of a charged particle in a constant electric field. (7.5)

(b) Show that the charged particle follows a parabolic path in transverse electric field. (5)

18. (a) Explain in detail the phenomena of elastic collision of two particles. (10)

(b) A ball of mass m_1 moving with velocity u_1 strikes another ball of mass m_2 which is stationary. If the collision is elastic, calculate the fraction of the kinetic energy transferred to the second ball. (2.5)

19. (a) Obtain the expression for acceleration and kinetic energy of a body rolling down an inclined plane without slipping. (7.5)

(b) A solid cylinder radius 0.04m and mass 0.25kg rolls down an inclined plane with $\sin \theta = 0.1$. Find the acceleration and the total energy of the cylinder after 5 seconds. (5)

20. State and prove Kepler's laws of planetary motion.

21. Describe Michelson-Moreley experiment and discuss the implications of the negative result.

22. (a) State and prove the law of conservation of angular momentum. (5)

(b) Obtain the expression for the distance of closest approach of proton to a nucleus. (7.5)
