

KAMARAJ COLLEGE (Autonomous)

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

THOOTHUKUDI – 628 003

(5 Pages)

Reg. No:

Question Code No : 25001204

Course Code : 24UMPH31

UG Degree - End Semester Examinations, November 2025

Third Semester

B.Sc. PHYSICS

Mechanics

(For those who joined in July 2024 onwards)

Time : 3Hours

Maximum : 75 Marks

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer:

1. Which interaction is responsible for holding the earth and moon together?
(a) Strong (b) Weak
(c) Electromagnetic (d) Gravitational
2. The dimension of the gravitational force constant is
(a) $M^{-1}L^3T^2$ (b) $M^{-1}L^2T^3$

(c) $M^{-1}LT^2$ (d) $M^{-1}LT^3$

3. Linear momentum is conserved when net external force acting on the particle is

(a) Maximum (b) Minimum

(c) Equal (d) Zero

4. Which of the following is conserved in elastic collision?

(a) Momentum (b) Kinetic energy

(c) Both a and b (d) Neither momentum nor kinetic energy

5. The unit of power in CGS system is

(a) Watt (b) Joule/sec

(c) Ft-pounds/sec (d) Erg/sec

6. According to the work-energy theorem, the total change in the kinetic energy of the particle is equal to the _____ by a force.

(a) Total work done (b) Half of the work done

(c) Square of the work done (d) Twice the work done

7. The expression for rotational kinetic energy is

(a) $\frac{1}{2}mv^2$ (b) $\frac{1}{2}mv$

(c) $\frac{1}{2}I\omega^2$ (d) $\frac{1}{2}I\omega$

8. The kinetic energy of a body rotating about an axis through its centre of mass is
- (a) $\frac{1}{2} WMK$ (b) $\frac{1}{2} W^2 MK$
(c) $\frac{1}{2} W^2 M^2 K$ (d) $\frac{1}{2} W^2 M K^2$
9. The number of degrees of freedom for a particle moving freely in a space is
- (a) 3 (b) 6
(c) 9 (d) 4
10. The Lagrangian function is defined by
- (a) $L = T + V$ (b) $L = T + U$
(c) $L = T - V$ (d) $L = T - U$

PART - B (5 X 5 = 25 Marks)

**Answer ALL Questions choosing either (a) or (b).
Answer should not exceed 250 words.**

11. (a) State Newton's laws of motion.

(OR)

- (b) State Kepler's laws of planetary motion.

12. (a) Using Newton's laws of motion, derive the law of conservation of linear momentum.

(OR)

(b) Obtain expressions for the velocities of two colliding particles having different masses.

13. (a) Explain the significance of conservation laws in physics.

(OR)

(b) Distinguish between conservative and non-conservative forces

14. (a) Compare the analogous parameters of translational and rotational motion.

(OR)

(b) Define the moment of inertia of a rigid body about a given axis and about a fixed axis of rotation.

15. (a) Explain the principle of virtual work.

(OR)

(b) Make use of Lagrangian method to obtain the equation of motion of a simple pendulum.

PART - C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 500 words.

16. (a) Derive an expression for the escape velocity from the Earth's surface.

(OR)

(b) Using Boy's method, determine the value of G .

17. (a) With a neat diagram, explain the concept of the centre of mass of a system of particles.

(OR)

(b) State and explain the principle of conservation of angular momentum with suitable examples.

18. (a) Discuss the concept of work and power. How they are related?

(OR)

(b) State and prove the work–energy theorem.

19. (a) State and prove the theorems of parallel axes and perpendicular axes for the moment of inertia.

(OR)

(b) Obtain an expression for the acceleration of a body rolling down an inclined plane.

20. (a) What are constraints? and explain their classification.

(OR)

(b) Using D'Alembert's principle, obtain Lagrange's equation of motion for conservative system.