

QP CODE: 25050514



Reg No :

Name :

MSc DEGREE (CSS) EXAMINATION, DECEMBER 2025

First Semester

Core Courses - PH010102 - CLASSICAL MECHANICS

M Sc PHYSICS, MSc SPACE SCIENCE.

2019 Admission Onwards

C7A7B341

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. What are the difference between Newtonian mechanics and Lagrangian mechanics?
2. What is Hamilton's principle?
3. What do you mean by generalised momentum? Give the expression for it.
4. What do you mean by normal modes?
5. Give the expression for kinetic energy and potential energy for the vibration of a linear triatomic molecule.
6. What are the fundamental Poisson brackets?
7. What is differential scattering cross-section and total cross section in central force field?
8. Distinguish between polar and axial vectors.
9. What is Hamilton's principal function. Explain its physical significance.
10. What is Thomas precession?

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Derive the Lagrange's equation of motion for the motion of a particle in a plane polar coordinate system.
12. Obtain the expression for Hamiltonian for a charged particle in an electromagnetic field.
13. What do you mean by a small oscillations? Explain stable equilibrium, unstable equilibrium and neutral equilibrium with examples for each.





14. Evaluate the Poisson brackets $[X, J_x]$ and $[X, J_z]$ where J_x and J_z are angular momentum along X and Z directions.
15. Obtain the expression for reduced mass of a two body central force problem.
16. Obtain the expression for angular momentum of a rotating body in terms of Inertia tensor.
17. Obtain Hamilton-Jacobi equation for a Harmonic oscillator.
18. Apply Hamilton Jacobi theory to determine the equation of motion of a body falling vertically in a uniform gravitational field.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight 5 each.

19. Derive the expression for Lagrangian of a charged particle moving in a velocity dependent potential.
20. Explain Canonical transformations. Show that the four generating functions are related to each other by Legendre transformations.
21. Obtain Euler's equations of motion for a rotating body with a fixed point. Obtain an expression for the frequency of precession of the angular velocity about the symmetry axis in the force free motion of a symmetrical top.
22. Using action angle-variables, determine the frequency of motion of a harmonic oscillator.

(2×5=10 weightage)

