



QP CODE: 23003148



23003148

Reg No :

Name :

M Sc DEGREE (CSS) EXAMINATION, APRIL 2023

First Semester

CORE - PH010102 - CLASSICAL MECHANICS

M Sc PHYSICS, M.Sc. Space Science

2019 ADMISSION ONWARDS

6780B697

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. What are the advantages of Lagrangian mechanics over Newtonian mechanics?
2. Give the Lagrangian equation of motion for a particle in cartesian coordinate system.
3. What is Hamilton's principle?
4. Give the expression for kinetic energy and potential energy for the vibration of a linear triatomic molecule.
5. Show that the transformation $Q = 1/p$ and $P = qp^2$ is canonical.
6. Write the Hamilton's equations of motion in Poisson's bracket form.
7. What do you mean by a central force problem? Give an example.
8. What are Euler angles?
9. What is Hamilton's principal function. Explain its physical significance.
10. What are action-angle variables?

(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 two unequal masses connected by means of a string which passes over a pulley.
12. Establish the statement that homogeneity of space implies linear momentum of a body is a constant of motion.





13. What do you mean by a small oscillations? Explain stable equilibrium, unstable equilibrium and neutral equilibrium with examples for each.
 14. Show that the transformations $\mathbf{Q} = q_1$ and $\mathbf{P} = p_1 - 2p_2$ is canonical .
 15. Obtain the expression for angular momentum of a rotating body in terms of Inertia tensor.
 16. Obtain Euler's equations of motion for a rotating body with a fixed point under the action of a torque?.
 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. A)Discuss the Hamiltonian dynamics and derive the Hamilton's equations of motion.
B)Obtain the expression for Hamiltonian for a charged particle in an electromagnetic field.
 20. Obtain the resonant frequencies, normal modes and normal frequencies of two coupled pendulum
 21. What are Coriolis force? Obtain the expression for it. Discuss the effects of Coriolis force.
 22. Define relativistic Lagrangian and discuss the motion of a relativistic particle moving under constant magnetic field.
- (2×5=10 weightage)

