

(Pages : 3)

P – 5545

Reg. No. :

Name :

First Semester M.Sc. Degree Examination, September 2022

**Physics with Specialization in Nano science/Physics with Specialization in
Space Physics**

PHNS 511/PHSP 511 : CLASSICAL MECHANICS

(2020 Admission onwards)

Time : 3 Hours

Max. Marks : 75

PART – A

Answer **any five** questions. Each question carries **3** marks.

1. Differentiate between holonomic and non-holonomic constraints.
2. How does the value of eccentricity and energy determine the shape of the orbit in a central force problem?
3. Define stable, unstable and neutral equilibrium.
4. Write down the Hamilton-Jacobi equation and give its significance.
5. Obtain Hamilton's equations of motion. Explain their importance.
6. State the postulates of the special theory of relativity.
7. Write a short note on nonlinear differential equations.
8. Define Euler's angles for the orientation of a rigid body.

(5 × 3 = 15 Marks)

P.T.O.



PART – B

Answer **three** questions. Each question carries **15** marks.

9. (a) State and explain the inverse square law of force.
(b) Derive Kepler's law of planetary motion.

OR

10. (a) State and Explain D'Alembert's Principle.
(b) Obtain Lagrange's equations of motion from D'Alembert's principle.
11. (a) Obtain the Hamilton-Jacobi equation.
(b) Discuss harmonic oscillator problem using Hamilton Jacobi theory.

OR

12. (a) Obtain the first integrals of motion of a heavy symmetric top under gravity.
(b) Explain steady precession and nutation of a heavy symmetric top.
13. (a) Discuss the linear stability analysis.
(b) Explain the classification of fixed points based on this analysis.

OR

14. (a) Discuss mass-energy equivalence.
(b) Obtain the mass-energy relation and momentum.

(3 × 15 = 45 Marks)



PART – C

Answer **any three** questions. Each question carries **5** marks.

15. Obtain the equation of motion of a compound pendulum and find the period of small amplitude oscillations of the compound pendulum.
16. A simple pendulum has a bob of mass m with a mass m_1 at the moving support (pendulum with moving support). Mass m_1 moves on a horizontal line in the vertical plane where the pendulum oscillates. Find the normal modes and normal frequencies of vibration.
17. Obtain the fundamental frequencies of a simple harmonic oscillator by setting up the, action variables.
18. Obtain Hamilton's equations of motion for a simple pendulum. Hence find the expression for its period.
19. Define fractals and explain the meaning of fractal dimension by taking an example.
20. Give an account of Einstein's principle of equivalence. Explain the observable consequences of the general theory of relativity.

(3 × 5 = 15 Marks)

