

First Semester M.Sc. Degree Examination, February 2025

Physics/Physics with Specialization In Nano Science/Physics With  
Specialization In Space Physics

PH 211/PHNS 511/PHSP 511 : CLASSICAL MECHANICS

(2020 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

PART – A

(Answer any five, questions, 3 marks each)

1. What is meant by an inertial mass and gravitational mass? Is there any difference between two?
2. Explain the term inertia tensor.
3. What are normal modes? Explain.
4. Distinguish between a symmetric top, spherical top and rotor.
5. Explain the meaning of generating function and give example.
6. What are proper length and proper time?
7. What is Hamilton's principle function? Explain the physical significance of Hamilton's principle function?
8. What is logistic map? Explain.

(5 × 3 = 15 Marks)

P.T.O.



PART – B

(Answer all questions 15 marks each)

9. ✓ (a) Explain the principle of virtual work and D'Alembert's principle.  
(b) Derive the Lagrange's equations of motions from D'Alembert's principle.

OR

10. (a) Briefly explain the general properties of central force motion.  
(b) How the orbital motions are classified for different values of energy.

11. ✓ (a) Explain action- angle variable formalism.  
(b) Obtain an expression for the frequency of 1D-harmonic oscillator using action-angle variable.

OR

12. (a) What is velocity dependent potential? Explain.  
(b) Derive the Lagrangian type equation of a charged particle moving in an electromagnetic field.

13. ✓ (a) What is logistic equation and explain the formation of bifurcation and chaotic region?  
(b) Give the importance of Liapunov exponent to explain the formation of normal and chaotic region.

OR

14. (a) State and prove force and energy equations in relativistic mechanics.  
(b) Give a brief account of the evidences of the general theory of relativity.  
(3 × 15 = 45 Marks)

PART - C

(Answer any three questions 5 marks each)

15. The Hamiltonian,  $H = \frac{p^2}{2m} + \frac{kq^2}{2}$ . Find the Lagrangian corresponding to this Hamiltonian.
16. The potential function of a system is given by  $V = k(x^3 - 2x^2 + x)$ . Find the frequency of small oscillation about the stable equilibrium point.
17. A body of mass  $m$  is dropped from rest at a height  $h$  above the surface of the earth. Determine the Coriolis force as a function of time.
18. The transformation  $Q = (ap/x)$ ,  $P = bx^2$  is canonical. Obtain the values of 'a' and 'b'.
19. A particle gains energy so that its mass becomes  $2m_0$ . Evaluate the speed of the particle.
20. According to the special theory of relativity calculate the speed  $v$  of a free particle of mass  $m$  with total energy  $E$ .

(3 × 5 = 15 Marks)

