Name ..... **25P130 -S**

Reg. No .....

M. Sc. DEGREE END SEMESTER EXAMINATION : NOVEMBER 2025

SEMESTER 1 : PHYSICS

COURSE : **21P1PHYT02 : CLASSICAL MECHANICS**

(For Supplementary -2023/2022/ 2021 Admissions)

Time : Three Hours Max. Weights: 30

PART A

Answer any 8 questions **Weight: 1**

1.	Prove the fundamental property of Poisson bracket [F,GS] = [F,G]S+G[F,S].	(A)
2.	Write the Hamilton - Jacobi equation in terms of Hamilton's characteristic function and mention the terms.	(U)
3.	Generalised co-ordinates need not have dimensions of length . Likewise components of generalised force do not neccesarily have the dimensions of force. Justify your answer.	(U)
4.	What do you mean by nutation?	(U, CO 3)
5.	State and explain the principle of least action.	(U)
6.	Prove that the Poisson bracket [F,G] = -[G,F].	(A)
7.	What are rheonomic constraints? Give an example.	(U)
8.	Sketch the normal modes of two coupled pendula.	(An)
9.	Why Hamilton's equations are called canonical equations?	(An)
10.	Briefly explain Thomas precession rotation.	(U)

(1 x 8 = 8)

PART B

Answer any 6 questions **Weights: 2**

11.	Discuss how relativistic Lagrangian can be used to explain the motion of a charged particle in a constant magnetic field .	(A)
12.	Discuss homogentity of time and conservation of Hamiltonian.	(An)
13.	What are canonical transformations? What is its significance?	(An)
14.	Show that the Hamilton's principal function S is the generator of a canonical transformation to a new co-ordinate that measures the phase angle of the oscillation and to a new canonical momentum α identified as the total energy.	(A)
15.	Obtain the Hamiltonian and Hamilton's equations of motion for a projectile. Neglect earth's rotation and air resistance.	(A)
16.	For small displacements, the condition for stable equilibrium is that the potential energy is minimum at the equilibrium configuration. Substantiate.	(An)
17.	Explain an orthogonal transformation.	()
18.	What is coriolis force? Describe its effect due to earth's rotation.	(An)

(2 x 6 = 12)

PART C

Answer any 2 questions **Weights: 5**

19.	Show that the coriolis force acting on a body of mass 'm', moving in a rotating frame is $-2m(w \times v)$, where 'w' is the angular velocity of the rotating frame and 'v' is the velocity of the body in the rotating frame.	()
20.	Outline the Hamilton-Jacobi theory and apply it to solve the problem of a one-dimensional harmonic oscillator.	(A)
21.	Obtain Lagrange's equations for a system of two coupled pendulum. Obtain the normal co-ordinates and normal modes.	(An)
22.	Discuss calculus of variations and derive Lagrange's equations from Hamilton's principle.	(A)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 3	understand the basic ideas of central forces and rigid body dynamics	U	4	1

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;