25PHP101/22PHP205N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2025
(First Semester)

Branch - **PHYSICS**

CLASSICAL MECHANICS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Identify the Lagrangian of a system. a)T + V b) T – V c) V – T d) 2T + V	K1	CO1
	2	The number of generalized coordinates is equal to_____. a) Degrees of freedom b) Number of particles c) Constraints d) Dimension of space	K2	CO1
2	3	Which of the following is related to principle of least action? a) Newton's law b) Hamilton's principle c) Gauss's law d) Faraday's law	K1	CO2
	4	For a particle in a central force field, the Hamiltonian depends on _____. a) Position only b) Momentum only c) Position and momentum d) Force	K2	CO2
3	5	Identify which relates the Virial theorem. a) Potential and kinetic energy b) Mass and energy c) Force and acceleration d) Work and time	K1	CO3
	6	Give the number of generalized coordinates for rigid body. a) 2 b) 3 c) 6 d) 9	K2	CO3
4	7	Which function is used to generate canonical transformation? a) Work function b) Generating function c) Potential function d) Force function	K1	CO4
	8	Hamilton–Jacobi equation is a _____. a) Differential equation b) Integral equation c) Matrix equation d) Algebraic equation	K2	CO4
5	9	Who proposed special theory of relativity? a) Isaac Newton b) Albert Einstein c) Rutherford d) Galileo	K1	CO5
	10	Select the terms that relates the Lorentz transformations. a) Force and acceleration b) Space and time c) Mass and energy d) Work and power	K2	CO5

Cont...

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Explain about constrained motion, constraints and its classification with examples.	K4	CO1
		(OR)		
	11.b.	Analyze the equation of motion of a particle moving under a central force using Lagrangian method.		
2	12.a.	Derive and explain Hamilton's canonical equations in spherical coordinates.	K3	CO2
		(OR)		
	12.b.	Apply Hamiltonian formulation to two-dimensional isotropic harmonic oscillator.		
3	13.a.	Determine the scattering angle and differential scattering cross section in Rutherford's scattering experiment.	K5	CO3
		(OR)		
	13.b.	Estimate the condition for frequency of precession for the motion of a fast top under the action of gravity.		
4	14.a.	Deduce the transformation equations for the generating function.	K2	CO4
		(OR)		
	14.b.	Derive the expression for equation of motion in Poisson bracket form with its properties.		
5	15.a.	Derive expression for total energy using Lagrangian formulation of relativistic mechanics.	K5	CO5
		(OR)		
	15.b.	Explain the Minkowski force and momentum in relativistic generalisation of Newton's laws.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Summarize the mechanics of a system of particles using Lagrangian approach with the conservation theorem for linear and angular momentum.	K5	CO1
2	17	Apply Hamiltonian formulation for a particle in a central force field and linear harmonic oscillator.	K3	CO2
3	18	Illustrate the working and Examine the principles behind Foucault's pendulum.	K3	CO3
4	19	Summarize the principle of least action for the Hamilton's formulation.	K5	CO4
5	20	Derive the Lorentz transformation equations.	K2	CO5

Z-Z-Z END