



**Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)**

M.Sc. (First Semester - Regular) Examinations, January – 2026
24MPHPC11002– Classical Mechanics
(Physics)

Time: 3 hrs

Maximum: 60 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A**(2 x 5 = 10 Marks)**Q.1. Answer *ALL* questions

	CO #	Blooms Level
a. Compare and Contrast Lagrangian and Hamiltonian mechanics.	CO1	K3
b. What is the physical significance of Liouville's theorem?	CO2	K1
c. What is the importance of the Kepler problem in mechanics?	CO3	K2
d. What is meant by orthogonal transformation?	CO4	K1
e. What is the advantage of discussing the motion of coupled oscillators in the normal modes?	CO5	K2

PART – B**(10 x 5 = 50 Marks)**Answer ALL the questions

	Marks	CO #	Blooms Level
2. a. Find the Lagrangian for a simple pendulum of length l and mass m , and derive its equation of motion.	7	CO1	K1
b. State and Proof D Alembert's Principle.	3	CO1	K2
(OR)			
c. Derive Newton's second law of motion from Lagrange's equation.	8	CO1	K3
d. The Hamiltonian of two particle system is $H = p_1 p_2 + q_1 q_2$. Where $q_1 q_2$ are generalized coordinate and $p_1 p_2$ are respective canonical momentum. Find the Lagrangian of the system.	2	CO1	K3
3.a. State and Briefly explain Liouville's Theorem regarding the conservation of density in phase space.	10	CO2	K3
(OR)			
c. If $[\alpha, \beta]$ be the Poisson bracket, then prove that $\frac{\partial}{\partial t} [\alpha, \beta] = \left[\frac{\partial \alpha}{\partial t}, \beta \right] + \left[\alpha, \frac{\partial \beta}{\partial t} \right]$	6	CO2	K2
d. Explain generating functions and discuss the four types of generating functions with their variables.	4	CO2	K3
4.a. Derive Hamilton-Jacobi equation starting from Hamilton's equation and write its significance.	10	CO3	K1
(OR)			
c. Explain Hamilton's principal function and show how it leads to canonical transformations.	7	CO3	K2
d. What type of motion is best described using action-angle variables?	3	CO3	K3
5.a. Discuss the orthogonal transformation for rotation and its properties.	8	CO4	K1
b. What is precession?	2	CO4	K3
(OR)			
c. Discuss the physical significance of Euler's equations with suitable examples.	7	CO4	K2

- d. What is nutation? 3 CO4 K1
- 6.a. Two identical simple Pendulum of length l mass m are coupled by a spring of constant k attached at their bobs. Find the Lagrangian for the system and derive the equation motion. Also describe the nature of oscillations. 10 CO5 K1
- (OR)
- c. A particle of mass m kept in a potential $V(x) = \frac{-kx^2}{2} + \frac{x^4}{4}$ when undergoes small oscillations about the equilibrium points. 7 CO5 K1
- d. Write a short note on vibrational modes of a triatomic molecule. 3 CO5 K3

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