GIET UNIVERSITY, GUNUPUR – 765022
M. Sc. (First Semester) Examinations, March – 2023
22PHPC102 - Classical Mechanics
(Physics)

Time: 3 hrs   Maximum: 70 Marks

(The figures in the right hand margin indicate marks.)

PART – A   **(2 x 10 = 20 Marks)**

Q.1. Answer all questions

		CO#	Blooms Level
a.	What is the precessional period of earth?	CO1	K2
b.	Explain different types of constrains with suitable examples.	CO1	K1
c.	Explain Legender transformation.	CO2	K1
d.	What is the physical significance of Hamiltonian?	CO2	K1
e.	What are fundamental Poisson's bracket?	CO3	K1
f.	Mention the Poisson's bracket of angular momentum.	CO3	K1
g.	What do you mean by symmetric and anti-symmetric mode?	CO4	K1
h.	Show that the transformation $Q=1/p$ and $P=qp^2$ is canonical.	CO3	K2
i.	If the Lagrangian of a system $L = \frac{1}{2}(q_1^2 + q_2^2 + q_1 q_2) - V(q)$, Find the Hamiltonian.	CO2	K2
j.	A particle of unit mass moves in a potential $V(x) = ax^2 + b/x^2$, where a and b are constants. What is the angular frequency of small oscillation about the minimum potential position?	CO4	K2

PART – B   **(10 x 5 = 50 Marks)**

<u>Answer *ANY FIVE* questions</u>

		Marks	CO#	Blooms Level
2. a.	Discuss the theory of a spinning symmetrical top under gravity with a special reference to steady precession.	7	CO1	K1
b.	Calculate the inertia tensor of the system of four point masses 1gm,2gm,3g,4gm, located at points (1,0,0), (1,1,0),(1,1,1),(1,1,-1) .	3	CO1	K2
3.a.	Find out the rotational K.E of rigid body	6	CO1	K1
b.	Explain torque free motion of a rigid body	4	CO1	K1
4. a.	Derive Euler-Lagrange's equation using variational principle.	7	CO2	K1
b.	Establish the relation between Lagrangian and Hamiltonian.	3	CO2	K1
5.a.	Discuss Brachistochrone Problem.	7	CO2	K1
b.	Obtain the Hamiltonian of an an harmonic oscillator whose Lagrangian is given by $L = \frac{1}{2}x^2 - \frac{1}{2}w^2 x^2 - ax^3$.	3	CO2	K2
6. a.	Discuss the concept of canonical transformation	8	CO3	K1
b.	Establish the relation between Lagrange and Poission bracket.	2	CO3	K1
7.a.	Show that Lagrange's bracket is invariant under canonical transformation.	7	CO3	K1
b.	What is the condition for canonical transformation?	3	CO3	AK1
8. a.	Discuss a two coupled pendulums in normal mode of oscillation with matrix formalism.	8	CO4	K1
b.	What do you mean by stable and unstable equilibrium?	2	CO4	K1

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