Enrollment No: _____ Exam Seat No:_____

C. U. SHAH UNIVERSITY

Winter Examination-2022

Subject Name : Classical Mechanics

Subject Code : 5SC01CLM1 **Branch: M.Sc. (Physics)**

Semester: 1 **Date: 03/01/2023** **Time: 11:00 To 02:00** **Marks: 70**

Instructions:

(1) Use of Programmable calculator and any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

SECTION – I

Q-1		**Attempt the Following questions.**	**(07)**
	a.	Define Generalized Coordinates.	**01**
	b.	Define Constraints.	**01**
	c.	Write Hamilton's equation of motion.	**01**
	d.	Write the general expression for Euler-Lagrange equation of motion.	**01**
	e.	Define Degree of Freedom.	**01**
	f.	State the conservation of angular momentum.	**01**
	g.	State the main difference between Newtonian and Lagrangian for system of particles.	**01**
Q-2		**Attempt all questions.**	**(14)**
	A	Write a note on Generalized coordinates.	**07**
	B	Obtain the Lagrangian for a simple Atwood's machine.	**07**
		OR	
Q-2		**Attempt all questions.**	**(14)**
	A	Using Hamilton's Equation, solve the Oscillator problem.	**07**
	B	Explain in detail the Degree of freedom with examples.	**07**
Q-3		**Attempt all questions.**	**(14)**
	A	Derive the Euler-Lagrange's equation of motion.	**07**
	B	Explain in detail various types of constraints with suitable examples.	**07**
		OR	
Q-3		**Attempt all questions.**	
	A	Deduce the expression for D'Alembert's Principle.	**07**
	B	Derive the equation of Hamilton's principle equation.	**07**

SECTION – II

Q-4		**Attempt the Following questions.**	**(07)**
	a.	Give the expression for Hamilton's canonical equation of motion.	**01**
	b.	Define Stable Equilibrium.	**01**

	c.	State two significances of Hamilton over Lagrangian.	**01**
	d.	Why Hamilton Principle is also known as 'Variational Principle'?	**01**
	e.	What do you mean by invariance under canonical transformation?	**01**
	f.	Give some examples where small oscillation theory is applicable.	**01**
	g.	Define normal modes.	**01**
Q-5		**Attempt all questions.**	**(14)**
	A	Explain Poisson's theorem in detail.	**07**
	B	Using the explanation of Canonical Transformation, obtain the Hamilton's canonical equations.	**07**
		OR	
Q-5		**Attempt all questions.**	
	A	Explain in detail Generating function.	**07**
	B	Deduce the characteristic equation for the case of two coupled oscillators.	**07**
Q-6		**Attempt all questions.**	**(14)**
	A	Enumerate on Poisson Bracket.	**07**
	B	Explain the working of Generating functions in obtaining new Hamiltonian for a system.	**07**
		OR	
Q-6		**Attempt all questions.**	
	A	Explain the Hamilton-Jacobi theory.	**07**
	B	Comment on Kepler's Problem using Lagrangian formulation.	**07**