STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
(For the candidates admitted from the academic year 2023-2024 & thereafter)
M.Sc. DEGREE EXAMINATION - APRIL 2026
SECOND SEMESTER

COURSE : CORE
PAPER : CLASSICAL MECHANICS
SUBJECT CODE : 23PH/PC/CM24
TIME : 3 HOURS **MAX. MARKS: 100**

Q. No.	SECTION A ANSWER ALL THE QUESTIONS (10x3= 30 Marks)	CO	KL
1	What is meant by characteristic function in H-J formulation?	1	1
2	State D'Alembert's principle.	1	1
3	Mention the types of constraints for a system of particles.	1	1
4	Define Generalized Coordinates and Degrees of Freedom.	1	1
5	State Euler's theorem on the motion of a rigid body.	2	2
6	Give the significance of finite and infinitesimal rotation in a rigid body.	2	2
7	What is Routh's procedure? When is it particularly useful?	2	2
8	Define Cyclic coordinates and state the related conservation theorem.	2	2
9	Evaluate the Poisson Bracket $[J_x, J_y]$.	3	3
10	Define normal coordinates in the context of small oscillations.	3	3
Q. No.	**SECTION B**	**CO**	**KL**
	Part A **ANSWER ANY TWO QUESTIONS** **(2 x 5 = 10 Marks)**		
11	A particle moves in a central force field. If the orbit is a circle passing through the force center, find the law of force.	3	3
12	Calculate the components of the inertia tensor for a uniform solid cube of mass M and side a about one of its corners.	3	3
13	Find the frequency of small oscillations for a simple harmonic oscillator using the Hamilton-Jacobi method.	3	3

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	Part B **ANSWER ANY SIX QUESTIONS (6 x 5 = 30 Marks)**		
14	Derive Lagrange's equations of motion from Hamilton's principle.	4	4
15	Explain the reduction of a two-body central force problem to an equivalent one- body problem.	4	4
16	Discuss the kinematics of a rigid body using Euler angles.	4	4
17	Derive the expression for the torque-free motion of a rigid body.	4	4
18	Prove the invariance of Poisson brackets.	4	4
19	Discuss the motion of a symmetric top under the influence of gravity.	4	4
20	Describe the Hamilton-Jacobi equation for Hamilton's principal function.	4	4
21	Discuss the vibrations of a linear triatomic molecule and find its normal modes.	4	4
Q. No.	**SECTION C** **ANSWER ANY TWO QUESTIONS** **(2 x 15 =30 Marks)**	**CO**	**KL**
22	Apply the Lagrangian formulation to solve the motion of an Atwood's machine and a simple pendulum.	5	5
23	Discuss the effect of the Coriolis force on a particle moving on the surface of the rotating Earth with schematic representation.	5	5
24	Apply the Action-Angle variable method to solve the Kepler problem and derive the frequency of the motion.	5	5
25	Formulate the eigenvalue equation for a system undergoing small oscillations and explain its principal axis transformation.	5	5

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