

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086  
(For candidates admitted during the academic year 2019 – 2020 and thereafter)

SUBJECT CODE : 19PH/PC/CM24

M.Sc. DEGREE EXAMINATION APRIL 2023

BRANCH III - PHYSICS

SECOND SEMESTER

COURSE : CORE  
PAPER : CLASSICAL MECHANICS  
TIME : 3 HOURS

MAX. MARKS: 100

**SECTION A**

ANSWER ALL THE QUESTIONS

(10x3=30)

1. What are holonomic and non-holonomic constraints?
2. State Hamilton's principle.
3. Define centrifugal and Coriolis force.
4. Brief on Euler's angles for the orientation of a rigid body.
5. State the commutative and distributive properties of Poisson brackets.
6. Explain about ignorable coordinates.
7. What is Hamilton's principal function?
8. Define action variable and angle variable.
9. What is a normal coordinate?
10. Draw the schematics of a double pendulum.

**SECTION B**

ANSWER ANY FIVE QUESTIONS

(5x5=25)

11. Set up Lagrangian and obtain the Lagrange's equation for a simple pendulum. Deduce the formula for its time period.
12. What do you mean by inertia tensor? Give its physical significance.
13. If  $F$  and  $G$  are functions of position co-ordinates  $q_i$ , and momentum co-ordinates  $p_i$ , define the Poisson's brackets of  $F$  and  $G$ . Prove that i)  $[F, G] = -[G, F]$  ii)  $[q_i, p_j] = -\delta_{ij}$
14. Explain how Kepler's problem can be solved by the method of action-angle variables.
15. Deduce eigen value equation for small oscillations.
16. What is meant by equation of motion and first integrals? Show that the areal velocity of a planet remains constant.
17. Deduce Euler's equations of motion for a rotating rigid body.

**SECTION C**

ANSWER ANY THREE QUESTIONS

(3x15=45)

18. Derive Lagrange's equation of motion from D'Alembert's principle.
19. What is meant by nutation and spin motion of symmetric top? Derive Euler's equations of motion for a symmetric top molecule.
20. State Hamilton's variation principle. Deduce canonical equations from variation principle.
21. Derive Hamilton Jacobi equation and apply it to solve the harmonic oscillator problem.
22. Discuss the vibration of linear triatomic molecule.

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