STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI- 86
(For candidates admitted during the academic year 2019 – 2020 and thereafter)

SUBJECT CODE :19PH/PC/CM24

M.Sc. DEGREE EXAMINATION APRIL 2022
PHYSICS
SECOND SEMESTER

COURSE : CORE
PAPER : CLASSICAL MECHANICS
TIME : 3 HOURS **MAX. MARKS: 100**

SECTION A

ANSWER ALL THE QUESTIONS **(10x3=30)**

1. What is a velocity dependent potential? Give an example.
2. For the Lagrangian $= \frac{m}{2}\left(\dot{r}^2 + r^2 \dot{\theta}^2 \right) - \frac{V}{r}$. Determine the generalized momenta.
3. Shows that the kinetic energy T for a torque free motion of a rigid body is a constant of motion.
4. Explain moment of inertia and products of inertia?
5. Give the differences between the Lagrangian and Hamiltonian methods in determining the equation of motion?
6. Show that Poisson bracket has antisymmetric property.
7. What is Jacobi identity?
8. What are the action angle variables?
9. Explain the terms stable and unstable equilibrium.
10. What are normal modes of vibration?

SECTION B

ANSWER ANY FIVE QUESTIONS **(5x5=25)**

11. Explain the different constraints of motion with suitable examples.
12. State and prove D'Alembert's principle.
13. Write a note on Coriolis effect.
14. Give an account of fundamental Poisson's brackets.

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15. For what values of α and β do the equations $Q = q^{\alpha}\cos\beta p$ and $P = q^{\alpha}\sin\beta P$ is canonical.
16. Solve the motion of a particle in one dimension whose Hamiltonian is given by

    $H = \frac{p^2}{2m} + V(q)$ by the Hamilton-Jacobi method.
17. Deduce the eigenvalue equation for small oscillations.

SECTION C

ANSWER ANY THREE QUESTION (3x15=45)

18. What are Kepler's laws of planetary motion? Derive expressions for all the three Kepler's laws of planetary motion.
19. Define Euler's angles and obtain an expression for the complete transformation matrix.
20. Define canonical transformation and obtain the transformation equations corresponding to F1 and F2 generating functions.
21. Prove by Hamilton Jacobi theory that the orbit of a planet around the sun is an ellipse.
22. Applying the theory of small oscillations, determine the eigen values and eigen vectors for a linear triatomic molecule.

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