

22P106

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Name:

Reg.No:

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2022

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19P PHY1 C01 - CLASSICAL MECHANICS

(Physics)

(2019 Admission onwards)

Time : 3 Hours

Maximum : 30 Weightage

Section A

Answer *all* questions. Each question carries 1 weightage.

1. State and explain principle of least action.
2. Define the hamiltonian of a system. Under what conditions, is it the total energy of the system?
3. What is the physical significance of action angle variable method?
4. When do you say a body is a symmetric top? Distinguish between symmetric top and assymmetric top.
5. Obtain the Euler equations of motion for a rigid body with one point fixed.
6. Discuss the vibrations of linear triatomic molecule.
7. What do you mean by limit cycles? Write down a nonlinear differential equation.
8. Explain the term universality.

(8 × 1 = 8 Weightage)

Section B

Answer any *two* questions. Each question carries 5 weightage.

9. Obtain the Lagranges equations of motion using D'alemberts principle.
10. Define angle of scattering. Deduce an expression for angle of scattering in a central force field.
11. Solve linear harmonic oscillator using Hamiltonian Jacobi formulation.
12. Prove by HJ theory that the orbit of a planet round the sun is an elliptic one with the sun at one of its foci.

(2 × 5 = 10 Weightage)

Section C

Answer any *four* questions. Each question carries 3 weightage.

13. A particle of mass m is projected with initial velocity u at an angle x with the horizontal. Use the Lagranges equations to describe the motion of the projectile. The resistance of air is neglected.
14. $Q = aq + bp$ and $P = cq + dp$, Prove that the above transformation is canonical only if $ad - bc = 1$

15. Prove that a function whose Poisson bracket with Hamiltonian vanishes is a constant of motion.
16. Verify any four fundamental properties of Poisson bracket.
17. Obtain the components of the angular velocity along the body set of axes in terms of Euler angles.
18. A simple pendulum has a bob of mass m with a mass m_1 at the moving support. Mass m_1 moves on a horizontal line in the vertical plane in which the pendulum oscillates. Find the normal frequencies and normal modes of vibration.
19. Discuss the iteration of logistic equation $x_{n+1} = ax_n(1 - x_n)$, (where a is the control parameter with the variable x) with $a=2$, $a=3.2$ and $a=4$.

(4 × 3 = 12 Weightage)
