

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2024
(Regular/Improvement/Supplementary)

PHYSICS
FPHY1C01-CLASSICAL MECHANICS

Time: 3 Hours**Maximum Weightage: 30****Part A: Short answer questions. Answer *all* questions. Each carries *one* weightage.**

1. What do you mean by constraints? Give any one example for holonomic and non-holonomic constraints?
2. State and explain D'Alembert's principle.
3. Obtain the Lagrange's equation of a spring mass system.
4. Explain the principle of least action.
5. Discuss any two properties of Poisson bracket.
6. Briefly explain moment of inertia tensor.
7. Discuss the concept of space set of axes and body set of axes.
8. What do you mean by universality of chaos?

(8 × 1 = 8 weightage)

Part B: Essay questions. Answer any *two* questions. Each carries *five* weightage.

9. Discuss linear harmonic oscillator using Hamilton -Jacobi method.
10. Derive Euler's equation of motion of a rotating rigid body. Show that angular momentum and kinetic energy is conserved in torque free motion.
11. Explain scattering in a central force field. Obtain the expressions for scattering angle in center of mass coordinates and laboratory co-ordinates.
12. Discuss fixed points and period doubling bifurcation with respect to Logistic map.

(2 × 5 = 10 weightage)

Part C: Problems. Answer any *four* questions. Each carries *three* weightage.

13. State Hamilton's principle. Derive Lagrange's equation from Hamilton's principle.
14. Explain stable, unstable and neutral equilibrium with examples.

(P.T.O.)

15. The Lagrangian of a system is $L = \dot{x}^2 + 2\dot{x}$. Find the corresponding Hamiltonian.
16. Check whether the transformation $Q = q \tan p$ and $P = q \log(\sin p)$ is canonical or not?
17. A rigid body consists of three particles of masses 1 kg, 2 kg and 3 kg located at points (1,0,1)m, (2,1,3)m, (1,0,2)m. Determine the moment of inertia tensor of the body.
18. Obtain the normal mode frequencies of a linear tri-atomic molecule.
19. Explain any three types of singular points of phase space trajectories with examples.

(4 × 3 = 12 weightage)