

24P106

(Pages: 2)

Name: .....

Reg.No: .....

**FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2024**

(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. What are constraints? Classify the constraints with some examples.
2. Define the hamiltonian of the system. Under what conditions, is it the total energy of the system.
3. Show that the poisson bracket of constants of motion with the hamiltonian is zero.
4. Obtain the equation of motion of a dynamical variables  $F(q,p,t)$  in terms of the poisson bracket.
5. What are action and angle variables?
6. Obtain an expression for frequency of a harmonic oscillator using HJ method.
7. Obtain the normal frequencies of linear triatomic molecule.
8. Explain the term universality.

**(8 × 1 = 8 Weightage)**

**Section B**

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

9. State and prove hamiltons principle. Derive lagranges equation from hamilton principle.
10. Define scattering cross section. Derive an expression for scattering cross section in terms of angle of scattering.
11. Describe force free motion of rigid body.
12. Derive euler geometrical equations interms of angular velocity components.

**(2 × 5 = 10 Weightage)**

**Section C**

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

13. Find the lagrangian of an electric charge  $q$ , of mass  $m$  moving at a velocity  $v$ , in an electromagnetic field.
14. Show that the transformation  $P=1/2(p^2+q^2)$ ,  $Q = \tan^{-1}q/p$  is canonical.
15. Apply HJ theory to determine the motion of a body falling vertically in a uniform gravitational field.

16. Find the moments and products of inertia of a homogeneous cube of side  $a$  for an origin at one corner, with axes directed along the edges.
17. 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.
18. Obtain the non linear oscillations of a pendulum.
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)**

\*\*\*\*\*