K23P 3099

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (C.B.C.S.S. – OBE – Regular)
Examination, October 2023
(2023 Admission)
PHYSICS
MSPHY01C01 : Classical Mechanics

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **any five** questions. **Each** question carries **3** marks :

1. What are rheonomous and scleronomous constraints ? Illustrate with examples for each. What are the difficulties which are imposed by constraints in solving mechanical problems ?
2. Draw the equivalent one dimensional potential for attractive inverse square law of force illustrating the condition for circular orbits. Illustrate.
3. What is Legendre transformation ? Illustrate with example.
4. What is Poisson Bracket ? Discuss its properties.
5. Define action angle variables.
6. Distinguish between polar vectors and axial vectors. Illustrate each with examples. **(5×3=15)**

SECTION – B

Answer **any three** questions. **Each** question carries **6** marks :

7. Find the Lagrange's equation of motion for the compound pendulum which oscillates in a vertical plane. Find the period of oscillation of the pendulum.
8. Consider the surface of revolution of a curve passing between two fixed points defining xy plane, and revolving about the y axis. Find that curve for which the surface area is minimum.

P.T.O.

9. What values of α and β do the equations $Q = q^{\alpha} \cos(\beta p)$ and $P = q^{\alpha} \sin(\beta p)$ represent a canonical transformation ? What is the form of generating function F_3 for this case ?

10. Using Hamilton Jacobi Equation solve Harmonic Oscillator problem.

11. Describe Coriolis force and derive an expression for the same. Find the effect on projective shot in the northern and southern Hemisphere of earth. **(3×6=18)**

SECTION – C

Answer **any three** questions. **Each** question carries **9** marks :

12. Discuss Kepler problem as an example of inverse square law of force and hence derive the elliptical orbit equation.

13. Derive Hamilton's equation of motion. Derive the Hamilton's equation of motion for a charged particle in electromagnetic field.

14. Show that Poisson Brackets are invariant under canonical transformation. Find the angular momentum Poisson brackets with the components of linear momentum. State Poisson's theorem on Poisson bracket.

15. Consider a linear triatomic molecule consisting of two atoms of mass 'm' placed symmetrically on each side of an atom of mass 'M'. Find the normal modes and frequencies of small oscillation of that molecule.

16. Discuss Euler's equation of motion and torque free motion of a rigid body and show that square of the angular momentum and kinetic energy are constants of motion. **(3×9=27)**