QP CODE: 23145382

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Reg No : .....

Name : .....

M Sc DEGREE (CSS) EXAMINATION, DECEMBER 2023

First Semester

CORE - PH010102 - CLASSICAL MECHANICS

M Sc PHYSICS,M.Sc.Space Science

2019 ADMISSION ONWARDS

04DE61D4

Time: 3 Hours | Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. What are the difficulties introduced by constraints in the solution of mechanical problems?
2. What do you mean by isotropy of space and homogeneity of time?
3. What is Legendre transformation?
4. What are normal coordinates?
5. Prove that the generating function $F= \Sigma_i q_i P_i$ generates identity transformation.
6. What do you mean by canonical transformations?
7. What is first integral of motion in central force?
8. What are infinitesimal rotations?
9. Illustrate the method of separation of variables in Hamilton-Jacobi equation.
10. What is Thomas precession?

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. A bead is sliding on a uniformly rotating wire in a force-free field. Obtain the Lagrange's equation of motion.
12. Using variational principle show that the shortest distance between two points is a straight line.
13. Define poisson brackets of two dynamic variables F and G and give any four properties.
14. Evaluate the Poisson bracket $[Z,J_x]$ where J_x is the angular momentum along the X direction.
15. Show that the Kepler's second law is a direct consequence of the conservation of angular momentum.
16. Four mass points each of mass m are placed at (a, 0, 0), (0, a, 0), (0, 0, a) and (a, a, a). Evaluate the inertia tenser of the system.
17. Obtain Hamilton-Jacobi equation for a Harmonic oscillator.
18. Obtain an expression for amplitude dependent correction on the period of a relativistic one dimensional harmonic oscillator.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Derive the expression for Lagrangian of a charged particle moving in a velocity dependent potential.
20. Obtain the normal mode frequencies of a linear triatomic molecule.
21. Discuss the central force problem for the reduction of two body problem to equivalent one body problem.
22. Using action angle-variables, determine the frequency of motion of a harmonic oscillator.

(2×5=10 weightage)