M.Sc. DEGREE EXAMINATION,NOVEMBER 2018
I Year I Semester
Core Major -II
CLASSICAL MECHANICS AND RELATIVITY

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. What are cyclic coordinates?
2. Distinguish between Lagrangian and Hamiltonian formalism.
3. What is meant by rigid body? Is it possible to have perfect rigid body?
4. State Euler's theorem.
5. What is the condition to be satisfied for the transformation to become canonical?
6. Prove that the distributive law [F, G+K] = [F, G] + [F, K] for Poisson brackets holds good.
7. What is a continuous medium?
8. Distinguish between stable and unstable equilibrium.
9. State the postulates of special theory of relativity.
10. Give the Maxwell's equations of electromagnetic theory.
11. What is meant by central force?
12. State Coriolis force.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. Derive Lagrange's equations of motion from Hamilton's principle.
14. Obtain Euler's equations of motion for a rotating rigid body through Lagrange's method.
15. Show that the transformation defined by $q = (2P)^{\frac{1}{2}} \text{Sin } Q$, $p = (2P)^{\frac{1}{2}} \text{Cos } Q$ is canonical using Poisson bracket.

16. Discuss the general theory of small oscillations and hence obtain the secular equation.

17. Derive Lorentz transformation equations.

18. Derive Hamilton's canonical equations of motion from Hamilton's function.

19. Describe a symmetrical top and hence obtain its Lagrangian.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. State and prove Kepler's first two laws of planetary motion.

21. Define Euler's angles and obtain an expression for the complete transformation matrix.

22. What is a linear harmonic oscillator? Solve the problem of linear harmonic oscillator through Hamilton Jacobi theory.

23. Give an example for linear triatomic molecule. Discuss the theory of oscillation for a linear triatomic molecule with different modes of oscillations.

24. Derive the expressions for Lagrangian and Hamiltonian of a free particle in relativistic mechanics.

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