M.Sc. DEGREE EXAMINATION,NOVEMBER 2019
I Year I Semester
Classical Mechanics And Relativity

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

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

Answer any **TEN** questions

1. What is meant by Cyclic coordinate?
2. State Kepler is three laws.
3. How do you define a rigid body?
4. Write down the cyclic co-ordinates in the heavy symmetric top problem and discuss its consequence.
5. If $[\varphi,\psi\ ]$, be the Poisson brackets of φ and ψ then prove that ∂/∂t $[\varphi,\psi\ ] =$ $[\partial\varphi/\ \partial$t, $\psi]+[\ \varphi, \partial\ \psi/\partial$t].
6. Mention any two properties of Poisson brackets.
7. What is meant by the principal axis transformation?
8. How can you formulate the small oscillation problem?
9. What do you mean by space-like and time-like events?
10. State the postulates of special theory of relativity.
11. Define the term precession.
12. Define normal co-ordinates in small Oscillation.

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

Answer any **FIVE** questions

13. Obtain Hamilton s canonical equations of motion.
14. Narrate the moment of inertia tensor.
15. For a certain canonical transformation it is known that $Q = \sqrt{q^2} + p^2$, $F = \frac{1}{2}(q^2 + p^2) \tan^{-1} q \div p + 1/2\ pq$. Find P(q,p) and F(q,Q).
16. Derive harmonic Oscillator problem using Hamilton-Jacobi theory.
17. Prove that the four dimensional volume element 'dx dy dz dt ' is invariant under Lorentz transformation.
18. Deduce Lagrange's equation form Hamilton's principle.
19. Explain briefly the theory of small oscillations.

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

Answer any **THREE** questions

Deduce the Lagrange's equations from Hamilton's principle.

20. Explain the Euler angles and deduce the angular velocity interms of Euler s angle.
21. Discuss the nature of the canonical transformations generated by the following type 2 and type 3 generating functions.

    (i) F_2 (p q) = p_i,q_i and

    (ii) F_3 (p q) = -$p_i Q_i$
22. Obtain the resonant frequencies and normal modes for the free vibrations of a linear triatomic molecule and hence discuss the nature of vibrations.
23. Demonstrate that the Maxwell's equations are invariant under lorentz transformations.
24. Explain the relativistic Hamiltonian and Lagrangian for a free particle.

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