M.Sc. (Mathematics) (New CBCS Pattern) Semester-II

PSCMTH09 : Classical Mechanics

P. Pages : 2 **GUG/W/24/13749**

Time : Three Hours * 5 4 2 6 * Max. Marks : 100

Notes : 1. Solve **all five** questions.
2. Each questions carry equal marks.

UNIT - I

1. a) Discuss the extension of Hamilton's principle of non-holonomic system. **10**

b) Obtain the Lagrange's equation from the Hamilton's principle. **10**

OR

c) Obtain the equation of catenary by minimum surface of revolution. **10**

d) Prove that the shortest distance between the two point in a plane is a straight line. **10**

UNIT - II

2. a) Derive the Hamilton's equation from variational principle. **10**

b) Discuss the Routh's procedure by considering the Lagrangian L. **10**

OR

c) Obtain the Hamilton Canonical equation. **10**

d) State and prove the principle of least action. **10**

UNIT - III

3. a) Show directly that the transformations. **10**

$Q = \log\left(\frac{1}{a}\sin q\, p\right)$, $P = q.\cot p$ is canonical.

b) Obtain the equation $K = H + \frac{\partial F_2}{\partial t}$ and $K = H + \frac{\partial F_3}{\partial t}$ in case of canonical transformation. **10**

OR

c) Obtain the equation $p_i q_i - H = P_i Q_i - K + \frac{\partial F}{\partial t}$. **10**

d) Show that the fundamental Poisson bracket are invariant under Canonical transformations. **10**

UNIT - IV

4. a) State and prove Liouville's theorem. **10**

b) Show that the Poisson bracket are given by $[P_x, P_y] = 0, [P_x, L_z) = 0, [P_y, L_z) = P_x$ where P_x, P_y, P_z are constants of motion. **10**

OR

c) Explain the angular momentum Poisson bracket formulation. **10**

d) Discuss the symmetric group of mechanical system. **10**

5. a) Show that generalized momentum conjugate to a cyclic co-ordinate conserved. **5**

b) Prove that, a cyclic co-ordinate will be absent in Hamiltonian. **5**

c) Show that the transformation $P = \frac{1}{2}\left(p^2 + q^2\right)$ $Q = \tan^{-1}\left(\frac{q}{p}\right)$ is Canonical. **5**

d) Define the infinitesimal canonical transformations. **5**

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