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

PSCMTH09 : Classical Mechanics

P. Pages : 2 **GUG/W/23/13749**

Time : Three Hours * 7 3 3 5 * Max. Marks : 100

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

UNIT – I

1. a) Explain the brachistochrone problem. **10**

b) Find the shortest distance between two points in the plane. **10**

OR

c) Derive the Lagrange's equations from Hamilton's principle. **10**

d) Discuss the extension of Hamilton's principle to nonholonomic system. **10**

UNIT – II

2. a) Derive Hamilton's equations form a variational principle. **10**

b) Obtain the Hamilton's canonical equations. **10**

OR

c) Explain the Routh's procedure. **10**

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

UNIT – III

3. a) Show directly that the transformation $Q = \log\left(\frac{1}{q}\sin p\right)$, $P = q \cot p$ is canonical. **10**

b) If $F = F_1(q, Q, t)$ and $F = F_2(q, p, t)$ are generating functions of canonical transformation the prove that, **10**

i) $K = H + \frac{\partial F_1}{\partial t}$

ii) $P_i = \frac{\partial F_1}{\partial q_i}$

iii) $P_i = -\frac{\partial F_1}{\partial Q_i}$

OR

c) Explain the symmetric approach to canonical transformations. **10**

d) Obtain the equation $P_i \dot{q}_i - H = P_i \dot{Q}_i - K + \frac{dF}{dt}$. **10**

UNIT – IV

4. a) Discuss the angular momentum poisons bracket relations. **10**

b) Show that the constant of motion are generating functions of those infinitesimal canonical transformation which leave the Hamiltonian invariant. **10**

OR

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

d) State and prove Liouville's theorem. **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) Prove that the Poisson bracket of two constants of motion is also constant of motion. **5**

d) Obtain the equations $\dot{q}_i = [q_i, H]$ & $\dot{p}_i = [p_i, H]$. **5**

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