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

PSCMTH09 - Classical Mechanics

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

Time : Three Hours Max. Marks : 100

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

UNIT – I

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

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

OR

c) Prove that the generalized momentum conjugate to a cyclic coordinate is conserved. **10**

d) Show that a hoop rolls down the incline with one half the acceleration it would have slipping down a frictionless plane, and the friction force of constraint is $\lambda = \frac{Mg\sin\theta}{2}$ **10**

UNIT – II

2. a) Obtain canonical equation of Hamilton. **10**

b) Verify that the matrix J has the properties $J^2 = -1$ & $\tilde{J}\,J = 1$ and that its determinant has the value + 1. **10**

OR

c) Explain Routh's Procedure. **10**

d) State & Prove principle of Least action. **10**

UNIT – III

3. a) Show that the transformation **10**

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

b) Explain the simplistic approach to canonical transformations. **10**

OR

c) Prove that the fundamental Poisson brackets are invariant under canonical transformation. **10**

d) Obtain the equation **10**

$$p_i\,\dot{q}_i - H\;P_i\dot{Q}_i - k + \frac{df}{dt}$$

UNIT – IV

4. a) State & prove Liouville's Theorem. **10**

b) Show that the Poisson brackets are given by **10**
$\left[P_x, P_y\right]=0, \left[P_x, L_z\right]=P_y, \left[P_y, L_z\right]=P_x$

OR

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

d) Explain symmetry groups of mechanical systems. **10**

5. a) Obtain the equation of Catenary **5**
$x = a \cosh \frac{y-b}{a}$

b) Prove that a cyclic coordinate will be absent in the Hamiltonian. **5**

c) Show that all point transformations are canonical. **5**

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

****