M.Sc. (Mathematics) (NEP Pattern) Semester-II

Major DSC-3 - Classical Mechanics

P. Pages : 2 **GUG/W/24/15395**

Time : Three Hours * 6 2 6 8 * Max. Marks : 80

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

UNIT - I

1. a) To obtain the Lagrange's equation from the Hamilton's principle. **8**

b) Discuss the extension of hamilton's principle to non-holonomic system. **8**

OR

c) To obtain the equation of catenary by minimum surface of revolution. **8**

d) Prove that, the shortest distance between the two point in a plane is a straight line **8**

UNIT - II

2. a) Derive the Hamilton's equation from variational principle. **8**

b) Find the Hamilton of the system and show that the system is not conservative if the K-E & P-E of particle given by $T = \frac{1}{2} m \dot{r}^2$, $V = \frac{1}{r}\left[1 + \frac{\dot{r}^2}{c^2}\right]$. **8**

OR

c) To obtain the Hamilton canonical equation. **8**

d) State and prove the principle of least action. **8**

UNIT - III

3. a) To 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. **8**

b) Show directly that the transformation $Q = \log\left(\frac{1}{q} \cdot \sin qp\right)$, $P = q \cdot \cot p$ is canonical. **8**

OR

c) Obtain the equation : **8**

$$p_i\dot{q}_i - H = p_i\dot{q}_i - K + \frac{\partial F}{\partial t}.$$

d) Show that the fundamental Poisson bracket are invariant under canonical transformation. **8**

UNIT - IV

4. a) State and prove Liouville's theorem. **8**

b) Show that the Poisson bracket are given by $\left[p_x, p_y\right] = 0, \left[p_x, L_z\right] = 0, \left[p_y, L_z\right] = p_x$. **8**

OR

c) Explain the angular momentum Poisson bracket formulation. **8**

d) Discuss the symmetric group of mechanical system. **8**

5. a) Show that generalized momentum conjugate to a cyclic co-ordinate conserved. **4**

b) Prove that, a cyclic co-ordinate will be absent in Hamiltonian. **4**

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. **4**

d) Discuss the active view of the Canonical transformation. **4**

****