# S-490

Total Pages : 3 Roll No. .....

# MSCPH-502

**Classical Mechanics**

M.Sc. Physics (MSCPH)

lst Semester Examination, 2022 (Dec.)

**Time : 2 Hours]** **Max. Marks : 70**

**Note :** This paper is of Seventy (70) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

## SECTION–A

## (Long Answer Type Questions)

**Note :** Section 'A' contains Five (05) long answer type questions of Nineteen (19) marks each. Learners are required to answer any Two (02) questions only.

(2×19=38)

**1.** What is δ-variation? Establish Euler- Lagrange's equations.

**2.** Derive Lagrange's equations from De'Alembert's Principle for conservative system.

**3.** Derive Hamilton's equation of motion Give the physical significance of Hamiltonian.

**4.** Show that the Poisson brackets are canonically invariant.

**5.** Consider a system with N generalized coordinates $q_k$ described by a mass $m_{k1}$ and a potential V. The kinetic energy of the system is given by T. Obtain the formulation of small oscillations for the defined system. How would you calculate the normal frequency for such system?

## SECTION–B

## (Short Answer Type Questions)

**Note :** Section 'B' contains Eight (08) short answer type questions of Eight (08) marks each. Learners are required to answer any Four (04) questions only. (4×8=32)

**1.** What are generalized coordinates? Define constraints.

**2.** Obtain the Lagrange's equation of motion for compound pendulum.

**3.** Show that the transformation

$$Q = \log\left(1 + \sqrt{q}\cos p\right)$$

$$P = 2\sqrt{q}\left(1 + \sqrt{q}\cos p\right)\sin p$$

is canonical. Find the generating function F($p$, Q).

**4.** What are conservative laws? Prove that if there is no external force acting on a particle, then its linear momentum is conserved.

**5.** Define cyclic coordinates and discuss its applications.

**6.** Derive the differential equation for the orbit of a particle moving under the influence of a central force. Investigate the motion of the particle under the attractive inverse square law.

**7.** State and prove the virial theorem.

**8.** Derive the equation for orbit of a particle moving under the influence of an inverse square central force field. Also calculate the time period of motion in elliptical orbit.

---