A–1175

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

MSCPH-502

M.Sc. Physics (MSCPH)

Classical Mechanics

Examination February, 2026

Time : 2:00 Hrs. 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. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

(Long Answer Type Questions) (2×19=38)

***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.

1. State Hamilton's principle and derive Lagrange's equations of motion from it.

2. Discuss the two-body central force problem. Show that the motion of two interacting particles is equivalent to the motion of a single particle in an external field.

3. Apply the Hamiltonian formulation to illustrate the equations of motion to for a charged particle moving in an electromagnetic field.

4. Define canonical transformations and obtain the transformation equations corresponding to generating functions.

5. Consider a system with N generalized coordinates q_k described by a mass m_{kl} 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) (4×8=32)

***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.

1. What are constraints ? Explain the various types of constraints. Give their significance.

2. What is meant by the laboratory system and the center-of-mass system in a two-body scattering problem ?

3. Derive the differential equation for the orbit of a particle moving under the influence of a central force.

4. Show that earth's escape velocity is 11.2 km/s.

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

6. Show that the transformation :

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

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

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

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

8. Define cyclic coordinates and discuss its applications.

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