Total Pages : 3   Roll No. ....

MSCPH–502

M.Sc. PHYSICS (MSCPH)

(Classical Mechanics)

1st Semester Examination, 2024 (June)

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. State and prove the Kepler's laws of planetary motion.

3. What is differential scattering cross-section ?

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

5. Define canonical transformations and obtain the transformation equations corresponding to all possible generating functions.

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

2. State and prove the virial theorem.

3. An artificial satellite is revolving around the earth at a distance of 620 km. Calculate the orbital velocity and the period of revolution. Radius of the earth is 6380 km and acceleration due to gravity at the surface of the earth is 9.8 m/s^2.

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

5. What do you mean by non-inertial frame of reference ?

6. What are body and space coordinate systems in relation to the motion of a rigid body ?

7. The Lagrangian for a system can be written as :

$$L = a\dot{X}^2 + b\frac{\dot{y}}{x} + c\dot{X}\dot{Y} + fy^2\dot{X}\dot{Z} + g\dot{Y} - k\sqrt{x^2 + y^2}$$

Where a, b, c, f, g, and k are constants. What is the Hamiltonian ? What quantities are conserved ?

8. What do you understand by stable and unstable equilibria ?

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