

**K-412**

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Roll No. ....

## **MSCPH-502**

### **CLASSICAL MECHANICS**

M.Sc. Physics (MSCPH)

1st Semester Examination, 2023 (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. 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)**

**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. Establish the Lagrange's equation of motion. Give its importance.
2. 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.
3. Discuss alpha scattering in Coulomb's field.
4. Apply the Hamilton's equations to describe the motion of a simple harmonic oscillator and a compound pendulum.
5. What is generating function? Obtain canonical transformation equations corresponding to first two types of generating functions.

## **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.  $(4 \times 8 = 32)$

1. Prove that if external torque acting on the particle is zero, its angular momentum is conserved.

2. 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
3. Calculate the height of an equatorial satellite which is always seen over the same point of earth's surface. ( $G = 6.66 \times 10^{-11}$  SI units; Mass of earth  $M = 5.98 \times 10^{24}$  kg).
4. What is collision? What is the difference between elastic and inelastic collisions?
5. Differentiate between real and fictitious forces. What is Coriolis force?
6. How many generalized coordinates are needed to specify the motion of a rigid body?
7. A dynamical system has the Lagrangian

$$L = \dot{q}_1^2 + \frac{\dot{q}_2^2}{a + bq_1^2} + k_1q_1^2 + k_2\dot{q}_1\dot{q}_2$$

Where  $a$ ,  $b$ ,  $k_1$ ,  $k_2$  are constants. Find the equations of motion in the Hamiltonian formulation.

8. What is the condition of stable equilibrium in terms of potential energy?
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