Roll No. .....

72602

M.Sc. Physics 1st Sem. Examination–December, 2014

Classical Mechanics

Paper : II

Time : 3 hours ***Max. Marks : 80***

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard will be entertained after the examination.

Note : Attempt **five** questions in all, selecting **one** question from each Unit. Q. No. 1 is **compulsory**.

1. (a) State advantages of Lagrangian approach over Newtonian formulation. 4

   (b) Show that for a central force field angular momentum is conserved. 4

(c) Show that the generating function $\sum_i q_i Q_i$ generate exchange transformation. 4

(d) State principle of least action 4

UNIT – I

2. Explain symmetries of space and time. Also show their relation with different conservation laws. 16

3. State D'Alembert's principle and derive Lagrange's equation of motion from it. 16

UNIT – II

4. (a) Derive the equation of motion of a particle in a frame rotating with angular velocity ω about an axis in space explaining all the terms. 10

(b) Obtain the magnitude of coriolis and centrifugal acceleration for the motion of a particle on earth's surface. 6

5. Explain the term differential scattering cross-section. Derive the expression for scattering cross-section of α-particles in Rutherford scattering. 16

UNIT – III

6. Derive Hamilton-Jacobi equation. Solve the one dimensional harmonic oscillator problem using Hamilton Jacobi theory. 16

7. State Hamilton's principle using calculus of variation. Derive Lagrange's equation of motion. 16

UNIT – IV

8. (a) Show that the transformation :

$$Q = \frac{1}{p}; \quad P = qp^2 \text{ is canonical.} \qquad 6$$

(b) Prove Jacobi's Identity. 10

9. Explain stable and unstable equilibrium with examples. Obtain the Lagrange's equation of motion for small oscillations of a system in the neighbourhood of stable equilibrium. 16
