M.Sc. Semester—I (C.B.C.S. Scheme) Examination

PHYSICS

1–Phy-2 : Classical Mechanics

Time : Three Hours] [Maximum Marks : 80

Note :— (1) All questions are compulsory.

(2) All questions carry equal marks.

EITHER

1. (a) State and prove the conservation theory of linear momentum and angular momentum for System of Particles. 8

(b) State and explain the principle of virtual work. 8

OR

(p) Obtain an equation of motion for single particle experiencing dissipative force. 8

(q) Prove that "D'Alembert's equation represents the conservation of energy, if virtual displacements are regarded as real one". 8

EITHER

2. (a) Define the term constraint. Explain the types of constraints. Give suitable examples of each. 6

(b) What are generalised co-ordinates ? Explain their advantages. How these could be obtained ? 5

(c) What do you mean by degrees of freedom ? Explain what is meant by configuration space ? 5

OR

(p) Derive the Lagrange's equation using D'Alembert's principle for conservative system. 6

(q) Set up the Lagrangian for simple Pendulum and hence obtain equation of motion. 5

(r) Show that Lagrangian's equations are invariant under Gauge transformation. 5

EITHER

3. (a) Find the time period of oscillations of simple pendulum by using Hamilton's equation. 6

(b) Give physical significance of Hamilton's principle with necessary proof. 5

(c) Obtain Hamilton-Jacobi's equation. 5

OR

(p) What are Galilean transformations and show that Lagrangian equations are invariant under Galilean Transformations. 6

(q) Derive the Lagrangian equations of motion from Hamilton's principle. 5

(r) Explain homogeneity of time and conservation of energy. 5

EITHER

4. (a) How two body problem be reduced to one body problem under central force field ? 6

(b) State Kepler's Law's of planetary motion and derive Kepler's First Law. 5

(c) State and prove virial theorem. 5

OR

(p) Derive differential equation for Orbit, described by particle under central force. 6

(q) Explain why time average quantities are considered for bodies moving under central force. Give suitable example. 5

(r) Explain closure property of a circular orbit. 5

EITHER

5. (a) Show that Poisson bracket does not obey commutative law of algebra. 8

(b) Show that generating Function for the transformation $P = \frac{1}{Q}, q = PQ^2$ is $G = q/Q$. 8

OR

(p) Derive an expression for Lagrangian density for Longitudinal Oscillation in elastic rod. 8

(q) State and prove the Poisson's theorem. 8