Unit IV

8. (a) Find the expression for attraction at any point on the surface of spherical shell of radius "a" and mass M.

(b) Find the potential at any point inside a solid sphere of radius "a" and mass M.

9. (a) Show that a family of right circular cones with a common axis and vertex is a possible family of equipotential surfaces. Also find the potential function.

(b) Derive Poisson's equation for potential in a system of attracting system.

Roll No. ..... Exam Code : J-21

Subject Code—5543

M. Sc. EXAMINATION

(Batch 2017 Onwards)

(First Semester)

MATHEMATICS

MAL-513

Mechanics

Time : 3 *Hours* *Maximum Marks :* 70

Note : Attempt *Five* questions in all. Q. No. **1** is compulsory. All questions carry equal marks.

Compulsory Question

1. (a) Define Scleronomic and Rheonomic constraints along with one example for each.

(b) What do you mean by equimomental systems ?

(c) Define generalized potential.

(d) State Donkin's theorem and dual transformation.

(e) Define Lagrange's bracket along with its any *two* properties.

(f) State Hamilton's principle.

(g) Define attraction and potential for a system of particles.

Unit I

2. (a) Define principal axes and obtain the expressions for angular momentum and kinetic energy referred to principal axes.

(b) State and prove parallel axes theorem for moment of Inertia.

3. (a) Find the directions of the principal axes at one of the corners of a uniform rectangular lamina of sides "a" and "b".

(b) Obtain Lagrange's equations for a planetary motion.

Unit II

4. (a) State and derive Lagrange's equations for impulsive forces.

(b) Derive the expression for kinetic energy in terms of generalized velocities.

5. (a) State and derive Routh's equations.

(b) State and prove Jacobi-Poisson theorem.

Unit III

6. (a) Derive principle of least action. Also discuss the difference between this principle and Hamilton's principle.

(b) State and derive Whittaker's equations.

7. (a) Prove that the transformation :

$$P = \frac{1}{2}(p^2 + q^2); Q = \tan^{-1}\left(\frac{q}{p}\right)$$

is canonical.

(b) Show that Lagrange's bracket is invariant under Canonical transformation.