(b) Find the potential for a uniform solid sphere at an internal point. **5+6**

Or

What do you mean by equiponential surfaces ? Show that a family of right circular cones with a common axis and vertex is a possible family of equipotential surfaces. Also obtain the potential function. **11**

Roll No. ..... **Exam Code : J-19**

Subject Code—0353

M. Sc. EXAMINATION

(Batch 2011 Onwards)

(First Semester)

MATHEMATICS

MAL-513

Mechanics

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

Section A

Note : Attempt any *Seven* questions. **7×5=35**

1. State and prove perpendicular axis theorem along with its converse.

2. Determine the moment of inertia of a body about an axis whose direction cosines are $<l, m, n>$ in terms of these d.c.'s and A, B, C, D, E, F.

3. Find the directions of principal axes at one of the corners of a uniform rectangular lamina of sides "2p" and "2q".

4. Derive the expression for kinetic energy in terms of generalized velocities, when time is explicitly absent.

5. Define Hamiltonian variables and derive Hamilton's canonical equations.

6. State and prove Routh's equations.

7. State and derive Hamilton's principle.

8. State and derive Jacobi's equations for an ordinary conservative systems.

9. Find expression for attraction at any point on axis of a uniform circular disc of radius '*a*'.

10. Find the distribution of matter when the potential outside a certain cylindrical boundary is zero, inside is $V = x^3 - 3xy^2 - ax^2 + 3ay^2$.

Section B

Note : Attempt all the questions.

11. Define equimomental systems. Derive the necessary and sufficient conditions for two systems to be equimomental. **12**

Or

(a) Derive energy equation for conservative fields.

(b) State and derive Poisson's identity. **5+7**

12. (a) State and prove Donkin's Theorem

(b) State and prove Jacobi's Theorem. **6+6**

Or

Explain Lagrange's bracket along with its properties. Also show that Lagrange's brocket is invariant under canonical transformations. **12**

13. (a) Find the values of *m* and *n* so that the transformations :

$P = q^m \sin np;\ Q = q^m \cos np;$

are canonical