10. (a) Show that the transformation is canonical $Q = \frac{1}{2}(q^2 + p^2), P = -\tan\frac{q}{p}$. Also find the new Hamiltonian transformation is described for the case where the old Hamiltonian is $H = \frac{1}{2}(q^2 + p^2)$.

Or

(b) Define Poisson brackets. Use Poisson bracket show that the transformation $Q = \sqrt{e^{-2q} - p^2}, P = \cos^{-1}(Pe^q)$ is canonical.

S.No. 217

08PMA03

(For the candidates admitted from 2008–2009 onwards)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2017.

First Semester

Mathematics

MECHANICS

Time : Three hours Maximum : 75 marks

SECTION A — ($5 \times 5 = 25$ marks)

Answer ALL questions.

1. (a) State and prove D'Alembert's principle.

Or

(b) Find the equation of motion for a spherical pendulum of mass 'm' is suspended by a mass less wire of length $r = a + b\cos\omega t (a > b > 0)$.

2. (a) State and prove Kepler problem.

Or

(b) Derive Jacobi integral for non-holonomic system.

3. (a) Derive Hamilton's equation of motion.

Or

(b) Find the stationary values of the function $f = z$ subject to the constrains

$$\phi_1 = x^2 + y^2 + z^2 - 4 = 0$$
$$\phi_2 = xy - 1 = 0$$

4. (a) State and prove Jacobi's theorem.

Or

(b) Explain the Liouvelli's system.

5. (a) Show that Rheonomic transformation $Q = \sqrt{2q}e^t \cos P$; $\mathbb{P} = \sqrt{2q}\, e^{-t} \sin p$ is canonical.

Or

(b) Obtain the Jacobi's identify for Poisson bracket.

SECTION B — (5 × 10 = 50 marks)

Answer ALL questions.

6. (a) State and prove Konig's theorem for N particles.

Or

(b) Define constraint and explain its types with an example.

7. (a) Find the differential equation of motion for a spherical pendulum of length l.

Or

(b) Define Routhian function and derive $\frac{d}{dt}\left(\frac{\partial R}{\partial q_i}\right) - \frac{\partial R}{\partial q_i} = 0$.

8. (a) Discuss the principle of least action.

Or

(b) State and prove Geodesi problem.

9. (a) State and prove Stackel's theorem.

Or

(b) Derive the modified Hamilton-Jacobi equation for a conservative holonomic system.