LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **MATHEMATICS**

THIRD SEMESTER – NOVEMBER 2015

MT 3812 - CLASSICAL MECHANICS

Date : 05/11/2015 Dept. No. Max. : 100 Marks

Time : 09:00-12:00

Answer *ALL* the questions

1. a. State and prove the principle of virtual work

OR

b.Classify the motion of the following objects

i. Arrow---- ii. Compact disc.---- iii. Electron ----- iv. Fan blade ------ v. Honeybee ----- **[5]**

c. Derive the Lagrange's equation of motion and find the differential equation of motion for spherical pendulum of length l.

OR

d. Classify the constraints with reasons for the following cases

i. A bead moving on a circular wire.

ii. A sphere rolling down a rough inclined plane without slipping.

iii. The molecules moving inside a gas container **[15]**

2. a. Write down the Hamiltonian and Hamilton's equation for a particle in a central force field in space

OR

b. Find the Routh's function for the motion of a projectile. Hence deduce the equation of motion. **[5]**

c. State Hamilton's principle and deduce Lagrange's equation from Hamilton's principle.

OR

d. Derive the Hamilton's function and the Hamilton's canonical equation of motion and give the physical significance of Hamilton's function. **[7+8]**

3. a. Find the infinite decimal contact transformation and deduce the transformation equation in terms of Poisson bracket.

OR

b. Find the values of a and b so that the equation $Q = q^a \cos b p$, $P = q^a \sin bp$ represent a canonical transformation **[5]**

c. State and prove Integral Invariant theorem of Poincare

OR

d. Discuss about the motion of a top **[7+8]**

4. a. Derive the transformation equation for Infinite decimal contact transformation.

OR

b. Define dust cloud. State and prove Liouvilli's theorem. **[5]**

c. Derive the conservation theorem of angular momentum using Infinite decimal contact transformation

OR

d. Derive the Hamilton – Jacobi equation for the Hamilton's principle function S. **[15]**

5. a.Discuss the motion of a particle moving in a plane under the action of central force using Hamilton - Jacobi equation.

OR

b. Find the action and angle variable for simple Harmonic Oscillator **[5]**

c. Derive the Hamilton – Jacobi equation for the Hamilton's characteristic function

OR

d. Discuss Kepler's problem using action angle variable. **[15]**

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