Enrollment No: _____ Exam Seat No: _____

C.U.SHAH UNIVERSITY

Winter Examination-2015

Subject Name: Classical Mechanics

Subject Code: 5SC01PHC2 **Branch: M.Sc.(Physics)**

Semester: 1 Date: 02/12/2015 Time: 10:30 To 1:30pm Marks: 70

Instructions:

(1) Use of Programmable calculator and any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

SECTION – I

Q-1 **Attempt the Following questions** **(07)**

a. Gives types of orbits. **01**
b. What is meant by conservation of angular momentum? **02**
c. Define scattering cross section. **02**
d. Write law of conservation of energy. **02**

Q-2 **Attempt all questions** **(14)**

a) Write a short note on Viral theorem. **05**
b) Derive the Lagrange's equations from Hamilton's principle. **05**
c) Explain conservation of energy in details. **04**

OR

Q-2 **Attempt all questions** **(14)**

a) Find the equation of orbit and classify different types of orbits on the basis of energy and eccentricity. **05**
b) Derive the differential equation of orbit. **05**
c) Discuss Hamilton's principal function. **04**

Q-3 **Attempt all questions** **(14)**

a) Derive the inverse square law of force. **07**
b) Explain in detail Bertrand's theorem with necessary mathematical expression. **07**

OR

Q-3 **Attempt all questions** **(14)**

a) Explain in details Rutherford Scattering. **07**
b) Derive equation of motion and its first integrals. **07**

SECTION – II

Q-4 **Attempt the Following questions** **(07)**

a. What is impact parameter in Scattering? **01**
b. What is inertial frame of reference? **01**
c. Write properties of Poisson bracket. **01**
d. For poison's brackets prove [X,X]=0 **02**
e. Explain with example stable and unstable equilibrium in small oscillations. **01**
f. Write formula of Hamilton-Jacobi equation. **01**

Q-5 **Attempt all questions** **(14)**

a) Discuss the Eigen vectors and Eigen frequencies using two coupled Pendulum. **05**
b) Prove (1) [x, y + z] = [x, y] + [x, z] and (2) [qi, qj]q, p = δ_{ij}. **05**
c) What is coriolis force? Explain. **04**

OR

Q-5 **Attempt all questions** **(14)**

a) What are normal co-ordinates? Explain in detail. **05**
b) Show that the angular acceleration is the same in Fixed and Rotating frames. **05**
c) Find out the relation $[L_x, L_y]=L_z$. **04**

Q-6 **Attempt all questions** **(14)**

a) Obtain Hamilton's characteristics function and find the relation in which the time is a co-ordinate and Hamiltonian is its conjugate momentum. **07**
b) Explain Gauge transformation in details. **07**

OR

Q-6 **Attempt all Questions** **(14)**

a) What is canonical transformation? Obtain the transformation equation for generating function F1. **07**
b) Derive the Hamilton-Jacobi equation for Hamilton's principal function with suitable equations. **07**