Seat No:_____ Enrollment No:_____

PARUL UNIVERSITY

FACULTY OF APPLIED SCIENCE

M.Sc. Winter 2018-19 Examination

Semester: 1 **Date: 03/12/2018**
Subject Code: 11204102 **Time: 10:30 am to 1:00 pm**
Subject Name: Classical Mechanics – I and Statistical Mechanics **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1. A) Essay type **(08)**

(a) Explain Gauge transformation.

(b) Explain Canonical transformation along with necessary derivations.

Q.1. B) Answer the following questions (Any two)

(a) Short note **(04)**

1. Discuss conditions for transformation to be canonical.
2. State Poisson theorem and state the Jacobi identity.

(b) Short note: Canonical equations in terms of Poisson Bracket equations. **(04)**

(c) Write a note on separation of variables. **(04)**

Q.2. A) Answer the following questions.

(a) Short note. **(04)**

1. With the help of suitable equation show Poisson Bracket is anti commutative.
2. Discuss Gauge transformation where Lagrangian is not unique.

(b) Short note: Small oscillations of particles on a string. **(04)**

Q.2. B) Answer the following questions (Any two)

(a) Multiple choice questions.(Each of 01 marks) **(03)**

1. When old and new coordinates are same, the function generates _____ transformation.
   a. Identity
   b. Null
   c. Canonical
   d. Both (a) and (c)
2. _____ are the generating function of the infinitesimal canonical transformations which leave the Hamiltonian unaffected or invariant.
   a. Identity
   b. Constant of motion
   c. Both (a) & (b)
   d. None of the above
3. The Poisson bracket of a function with itself is identically _____.
   a. Finite
   b. Infinite
   c. Zero
   d.Both (a) & (c)

(b) Short note: Euler's angles. **(03)**

(c) Short note: Motion of a symmetric top. **(03)**

Q.3. A) Essay type **(08)**

(a) Discuss equilibrium condition where in the pressure of the phases is same with the help of necessary derivations.

(b) Get the derivation of Clausius Clapeyron equations

Q.3. B) Answer the following questions (Any two)

(a) Short note **(04)**

1. Discuss briefly about physical interpretation of Clausius Clapeyron equation
2. Discuss in detail about Ising Model.

(b) Short note: Classification of Phase transitions. **(04)**

(c) Short note: Brownian Motion **(04)**

Q.4. A) Answer the following questions.

(a) Short note **(04)**

1. Give a pictorial representation of behavior of Gibb's free energy and entropy as a function of temperature at a transition point.
2. For equilibrium, the Gibb's energy per particle in the two phases must be ____.

(b) Short note: Curie Weiss theory of Magnetic transition. **(04)**

Q.4. B) Answer the following questions (Any two)

(a) Short note **(03)**

1. Define critical point.
2. Draw a neat and labeled phase diagram.
3. At a constant temperature and pressure, Gibb's free energy is proportional to _____.(number of particles, entropy)

(b) Short note: Van Der Waal's equation. **(03)**

(c) Short note: Second order phase transition **(03)**