Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2017

Subject Name: Introduction to Statistical Mechanics and Plasma Physics

Subject Code: 4SC06SMC1 Branch: B.Sc. (Physics)

Semester: 6 Date: 19/04/2017 Time: 02:30 To 05:30 Marks : 70

Instructions:

(1) Use of Programmable calculator & 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.

Q-1 Attempt the following questions: (14)

a)	Define Ideal gases.	1
b)	Name the three distributions according to which particles are arranged in their respective energy levels.	1
c)	Give the condition for the applicability of M.B. distribution.	1
d)	Define most probable energy.	1
e)	How is β related to temperature?	1
f)	Define macroscopic and microscopic states.	1
g)	Define phase space.	1
h)	State the Liouville's theorem.	1
i)	Define plasma.	1
j)	Define micro canonical ensemble.	1
k)	What do you mean by Plasma radiation?	1
l)	Give the criteria's for a gas to be Plasma.	1
m)	State the Nernst heat theorem.	1
n)	State Gibb's paradox.	1

Attempt any four questions from Q-2 to Q-8

Q-2 Attempt all questions (14)

a)	Derive the formula for the number of particles ni distributed in Ei energy levels following Maxwell Boltzmann statistics.	**7**
b)	Derive the formula for entropy of a perfect gas.	**7**

Q-3 Attempt all questions (14)

a)	Explain the concept of a microcanonical ensemble by deriving the formula for density distribution function.	**5**
b)	Derive the condition for the applicability of Maxwell Boltzmann distribution.	**6**
C)	A Maxwell Boltzmann gas has 2 particles in the i^{th} state whose degeneracy is 3. Find the number of independent ways of selecting the particles in the state.	**3**

Q-4 Attempt all questions (14)

a)	Explain the Gibb's paradox. How can you remove such a paradox?	**7**

	b)	Derive the formula for the density distribution function of a grand canonical ensemble.	**7**
Q-5		**Attempt all questions**	**(14)**
	a)	Derive the formula for the distribution of velocities according to the M.B. distribution.	**8**
	b)	Which are the various types of collisions? Explain them briefly.	**6**
Q-6		**Attempt all questions**	**(14)**
	a)	Derive the formula for plasma frequency based on the concept of plasma oscillations.	**10**
	b)	Explain the concept of equivalence of microcanonical and canonical ensembles.	**4**
Q-7		**Attempt all questions**	**(14)**
	a)	Explain the various properties of Plasma.	**7**
	b)	Explain the concept of magneto hydrodynamic energy conversion and ion propulsion.	**4**
	c)	Using $$n(E)dE = \frac{2\pi N E^{\frac{1}{2}} e^{\frac{-E}{KT}}}{(\pi KT)^{3/2}} dE$$ Derive the formula for the average energy of a particle following M.B statistics.	**3**
Q-8		**Attempt all questions**	**(14)**
	a)	Derive the formula for the distribution function of a canonical ensemble.	**7**
	b)	Explain briefly (a) electron impact dissociation (b) electron impact excitation (c) penning ionization (d) recombination and photo ionization.	**7**