K18P 0128

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree (Regular/Supplementary/Improvement) Examination, March 2018
(2014 Admn. Onwards)
PHYSICS
PHY2C08 : Statistical Mechanics

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **both** questions (either **a)** or **b)**) :

1. a) Define intrinsic and extrinsic thermodynamic variables. Derive the Euler and Gibb's Duhem thermodynamic relations.

   OR

   b) Discuss Gibb's paradox by deriving necessary equations. Obtain Sackur-Tetrode equation from it.

2. a) What is BE condensation ? Give a brief explanation of BE condensation in terms of entropy. Show that for B-E condensation, the number of particles in the ground state is given by $n_0 = n\left[1-\left(\frac{T}{T_0}\right)^{\frac{3}{2}}\right]$.

   OR

   b) Discuss the Landau theory of the order parameter. Explain how this theory shows that the sp heat is discontinuous at the phase point of the second order transitions ? **(2×12=24)**

SECTION – B

Answer **any four**. **One** mark for part **a)**, **3** marks for part **b)**, **5** marks for part **c)** :

3. a) Which are the four thermodynamic potentials ?
   b) Discuss the microscopic and macroscopic states of a system with any one example.
   c) Consider two identical particles. Each particle can be in one of the three possible quantum states 0, ϵ and 3ϵ. Find the number of microstates of the system for MB, BE and FD statistics. Also find the ratio of probability that the two particles are found in different states in each of the three cases.

P.T.O.

4. a) Distinguish between phase point and phase space.
   b) What are statistical postulates ?
   c) Show that the number of phase cells in a given energy range is proportional to $E^{3/2}$.

5. a) Define an ensemble.
   b) Distinguish between the three types of ensembles.
   c) Show that the entropy in canonical ensemble is given by $S = k[\beta < E> + \log Z]$ where <E> is the ensemble average of the energy of the system.

6. a) Give the relation connecting statistical and thermodynamical entropy.
   b) Write a note on the statistics of occupation numbers in quantum mechanical ensembles.
   c) Derive the expressions for average energy and average number of particles in a grand canonical ensemble.

7. a) Define Fermi velocity.
   b) What will be the pressure volume relation for an ideal Fermi gas at absolute zero temperature.
   c) Explain Landau diamagnetism of an ideal Fermi gas.

8. a) What is the basic condition to be fulfilled in Ising model ?
   b) Discuss the essence of 1-D Ising model. Show that it is not suitable for ferromagnetism.
   c) Derive Curie law for the spin half Ising paramagnet. **(4×9=36)**
