K19P 0305

Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (Reg./Suppl./Imp.) Examination, April 2019
(2014 Admission Onwards)
PHYSICS
PHY 2C08 – Statistical Mechanics

Time : 3 Hours Max. Marks: 60

SECTION – A

Answer **both** questions. (Either **a)** or **b)**).

1. a) State and prove Liouville's theorem.

OR

b) Discuss one dimensional Ising model for phase transitions.

2. a) Derive Bose-Einstein distribution law. How can it be applied to obtain Planck's formula for black body radiations ?

OR

b) What is Fermi energy ? Obtain an expression for energy of a Fermi gas at absolute zero. **(2×12=24)**

SECTION – B

Answer **any four** questions. (**1** mark for Part **a)**, **3** marks for Part **b)**, **5** marks for Part **c)**).

3. a) What are ensembles ?

b) Distinguish microstates from macrostates.

c) Explain Gibbs paradox. How is it resolved ?

4. a) Differentiate internal energy of a canonical and grand canonical ensemble.

b) Calculate the mean energy of a one dimensional harmonic oscillator.

c) Account for thermodynamics of a harmonic oscillator.

P.T.O.

5. a) What is meant by degrees of freedom ?
   b) State and prove the law of equipartition of energy.
   c) Express entropy in terms of partition functions.
6. a) What is meant by phase transition ?
   b) Distinguish first and second order phase transitions.
   c) Discuss the dynamical model of phase transitions.
7. a) State Bose-Einstein distribution law.
   b) Bring out the distinction between Bose-Einstein and Fermi Dirac statistics.
   c) Write short note on Bose-Einstein condensation.
8. a) Which distribution law will you use to study electron gas and why ?
   b) Two particles are to be distributed in two cells by FD statistics. Give the possible distributions.
   c) Calculate the Fermi energy in electron volts for sodium assuming that it has one free electron per atom. Given density of sodium is 0.97 g cm^{-3}.
   Atomic weight of sodium = 23. **(4×9=36)**
