K20P 0353

Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (CBSS – Reg./Suppl./Imp.) Examination, April 2020
(2014 Admission Onwards)
PHYSICS
PHY2C08 : 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. Discuss its physical significance.

   OR

   b) Define the four thermodynamic potentials and hence derive Maxwell's thermodynamic relations.

2. a) Discuss the effect of one dimensional Ising model. Show that it is not suitable for ferromagnetism.

   OR

   b) Derive Fermi-Dirac distribution formula. Apply it to obtain the theory of Pauli's paramagnetism. **(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 is meant by phase space ?
   b) Distinguish microstates from macrostates.
   c) Define ensemble. Differentiate between canonical, micro canonical and grand canonical ensemble.

4. a) Differentiate internal energy of a canonical and grand canonical ensemble.
   b) Calculate the mean energy of a one dimensional harmonic oscillator.
   c) Explain with the help of an example that a macrostate can have a number of microstates.

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5. a) What is meant by partition function ?
   b) Express Helmholtz free energy in terms of partition function.
   c) State and prove the law of equipartition of energy.

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 Fermi-Dirac distribution law.
   b) Write short note on Fermi energy and Fermi temperature.
   c) The Fermi energy in silver is 5.51 eV. What is the average energy of the free electrons in silver at 0 K ? At what temperature a classical free particle will have this kinetic energy ?

8. a) Which distribution law will you use to study photon gas and why ?
   b) Two particles are to be distributed in two cells by BE statistics. Give the possible distributions.
   c) What do you mean by BE condensation ? Calculate the critical temperature at which the condensation starts. **(4×9=36)**
