M 17306

Reg. No. : .....

Name : .....

IV Semester M.Sc. Degree Examination, March 2010
PHYSICS
PH-401 : Statistical Mechanics

Time: 3 Hours Max. Marks: 50

Instructions : *1) This question paper contains **three** Sections **A**, **B** and **C**.*
*2) Section – **A** contains **4** essay type questions, candidate has to answer **any two** questions.*
*3) Section – **B** contains **8** questions, can answer **5** questions.*
*4) Section – **C** contains **5** questions, can answer **3** questions.*

SECTION – A

Essay questions. Answer **any two** questions. **(2×10=20)**

1. What is Gibb's distribution ? Using this distribution obtain the expression for generalized equipartition of energies.

2. Distinguish between the three types of ensembles in statistical mechanics. Discuss the importance of grand canonical ensemble and explain density fluctuations in the grand canonical ensemble.

3. Explain the concepts of Bose-Einstein condensation. What do you mean by imperfect Bose-gas ?

4. Define ising model. Explain how this can simulate the lattice gas.

SECTION – B

Answer **any five** questions : **(5×3=15)**

5. What is Gibb's paradox ?

6. State and explain Liouville's theorem.

P.T.O.

7. Explain how the energy fluctuates in canonical ensemble.

8. State and prove equipartition theorem.

9. Define density operator.

10. Describe the behaviour of an ideal Bose gas.

11. Write the expression for the energy of a Fermi gas at absolute zero and mention its physical significance.

12. Explain the statistical equilibrium of white dwarfs.

SECTION – C

Answer **any three** questions : **(3×5=15)**

13. Obtain the pressure of a classical ideal gas as a function of N, V and T using partition function.

14. Show that the chemical potential

$$\mu = KT \log (\lambda^3 n)$$

15. Show that the translational entropy of an ideal gas in equilibrium at a temperature T.

$$S/k = 3/2\ N - N \log \left[N / V(2\pi h^2 / mkT)^{3/2} \right]$$

16. Find the internal energy for the Fermi and Bose gases and derive the relation connecting internal energy and pressure for an ideal Boltzmann gas.

17. Determine the magnetization per unit volume and the magnetic susceptibility per unit volume of an electron system.
