M 15811

Reg. No. : .....

Name : .....

IV Semester M.Sc. Degree Examination, May 2009
PHYSICS
(2006 Syllabus)
PH – 401 : Statistical Mechanics

Time : 3 Hours

Max. Marks : 50

Instruction : *Answer **two** questions from Section – **A**, **five** questions from Section – **B** and **three** questions from Section – **C**.*

SECTION – A

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

1. a) What is phase space and ensemble ? Distinguish between different types of phase space and ensembles.

   b) Show that for an isolated system in equilibrium the density of distribution in phase space is constant. **10**

2. Obtain the Maxwell-Boltzmann distribution law of particles and prove that the probability of distribution corresponds to the most probable distribution. **10**

3. Derive an expression for the Bose-Einstein distribution and show how it leads to the Planck's law of black body radiation. **10**

4. Deduce the Fermi-Dirac distribution law for a gas of non-interacting molecules. Comment on the degenerate Fermi gas. **10**

SECTION – B

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

5. Obtain the Boltzmann relation between entropy and thermodynamic probability. **3**

6. Explain the Gibb's paradox. **3**

P.T.O.

7. State and explain the Liouville's theorem. 3

8. Derive the condition for thermal equilibrium of two systems in thermal contact. 3

9. State and explain the Boltzmann equipartition theorem. 3

10. What are Bosons and Fermions ? 3

11. Discuss free-electron theory for metals. 3

12. Explain the spontaneous magnetization from ising model. 3

SECTION – C

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

13. A system has N distinguishable particles. Each particle has two non-degenerate states with level separation of 0.15 eV. Find the average number of particles in each state, when the system is in thermal equilibrium with a bath at temperature of 300 K. 5

14. Find out the chemical potential of a very dilute gas containing N structureless particles occupying a volume V at temperature T. 5

15. Find the condensation temperature for liquid Helium-4 assuming it to be a system of non-interacting particles. One mole of the liquid occupies a volume of 27.6 cm3. 5

16. Consider the number of quantum states of photons between the frequency υ and $\upsilon + d\upsilon$ in an enclosure of volume V. Calculate the average number of photons in this enclosure of 22.4 litres at 273 K. 5

17. Calculate the Fermi energy at 0K of metallic silver containing one free electron per atom. The density and atomic weight of silver is 10.5 gm/cm3 and 108 respectively. 5
