Reg. No. :.....

Name :.....

M 11867

Fourth Semester M.Sc. Degree Examination, May 2006

PHYSICS

PH-401 : Statistical Mechanics

(2004 Admn.)

Time: 3 Hours Max. Marks: 80

Instruction : *Answer* ***all*** *questions.*

PART – A

Essay questions – 3×12=36 marks :

1. a) Derive Bose-Einstein distribution law.

   b) How would it be used to obtain Plank's formula for the black body radiation ? **12**

2. What is Fermi gas ? Deduce an expression for the energy of a Fermi gas at absolute zero. Point out its physical significance. **12**

3. Define grand partition function. How can you obtain various thermodynamic quantities from it ? Discuss density fluctuations in grand canonical ensemble. **12**

3×12=36

PART – B

Short answer questions – 7×5=35 marks :

4. What is Gibb's paradox ? How it can be resolved ? **5**

5. What do you mean by the terms phase space and ensembles ? **5**

6. Define density matrix for various thermodynamic parameters from the density operator. **5**

7. Briefly explain equipartition theorem. **5**

P.T.O.

8. Show that the entropy at absolute zero in a canonical ensemble can be expressed as s = K.log go where go is the statistical weight of the ground state. 5

9. Discuss tree electron theory for metals. 5

10. Explain how ising model can simulate lattice gas. 5

7×5=35

PART – C

Problem type questions – 4×8=32 marks :

11. Consider that white dwart is an electron gas of density 10^{30} electrons per cm^3. Calculate the Fermi energy of the system and the corresponding Fermi temperature.

12. Show that $\mu = -\frac{KT}{N}$ as $T \rightarrow 0$ for a Bose-Einstein gas with ground state at $\varepsilon = 0$. 8

13. Using Heisenberg's uncertainty relation $\Delta P . \Delta q \leq \hbar/2$, show that the volume occupied by each energy state in Gamma space is $\left(\frac{\hbar}{2}\right)^{3N}$.

14. Show that the probability that a system in equilibrium with a heat reservoir at temperature T may exist in a microstate of energy εr is proportional to exp. $\left(-\frac{\varepsilon r}{KT}\right)$ where K is Boltzmann's constant. 4×8=32