F.Y.M.SC.(Physics) Second Semester OLD

0142 - Statistical Physics Paper – III

P. Pages : 2 **GUG/W/18/2240**

Time : Three Hours * 1 7 3 7 * Max. Marks : 80

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1. Either

a) State and prove Liouville's theorem. **8**

b) What do you mean by partition function? Express Helmholtz free energy and entropy in terms of partition function. **8**

OR

e) State fundamental assumptions of statistical mechanics which has enables us to deduce macroscopic properties of equilibrium state of an assembly of particles. **8**

f) Explain fluctuation in Thermodynamic quantities. **8**

2. Either

a) Explain Bose- Einstein condensation. How does it differ from ordinary vapour condensation. **8**

b) Discuss the specific heat of liquid He_2^4 by comparing with that of ideal bose system. **8**

OR

e) Explain the symmetry of wave functions for the system of indistinguishable particles. **8**

f) Explain gas degeneracy. **8**

3. Either

a) Derive FD distribution formula and show that the specific heat of a strongly degenerate Fermi – Dirac gas is directly proportional to the absolute temperature. **8**

b) Discuss the developments in the theory of specific heat. Prove that specific heat is directly proportional to cube of temperature for solid at low temperature. **8**

OR

e) Discuss the deviation of ideal fermi gas from the perfect gas in terms of weak and strong degeneracy. **8**

f) Obtain virial equation of state in terms of cluster integrals. **8**

4. Either

a) Discuss the Ising model for second order phase transition. **8**

b) Explain Langevin's theory of Brownian motion of particles. **8**

OR

e) Explain in detail scaling hypothesis. **8**

f) Explain the terms. **8**
i) Critical indices.
ii) Order parameter.

5. Attempt all the following questions.

a) Compare canonical, Grand – Canonical & microcanonical ensembles. **4**

b) Obtain an expression for Bose Temperature of ideal Bose system. **4**

c) Calculate the Fermi Energy for sodium assuming one free electron per atom. **4**
Given : density of sodium = 0.97 g/cm^3
Atomic weight of sodium = 23
h = 6.62 x 10^{-34} Js.
N = Avogadro Number = $6x10^{26} \frac{\text{atoms}}{\text{kg.mole}}$

d) Distinguish between first order & second order phase transition. **4**

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