M.Sc. First Year (Physics) CBCS Pattern Semester-II

PSCPHYT06 - Paper-III : Statistical Physics

P. Pages : 2 **GUG/W/23/11221**

Time : Three Hours Max. Marks : 80

* 6 2 4 9 *

Either:

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

b) What is Gibb's paradox? How it is resolved? **8**

OR

c) What is meant by ensembles? Discuss micro-canonical, canonical and grand canonical ensembles. **8**

d) Define partition function. Express Helmholtz free energy and entropy. **8**

Either:

2. a) Explain Bose-Einstein condensation. **8**

b) What is B-E statistics? Derive an expression $n_i = \frac{g_i}{e^{\alpha+\beta Ei}-1}$ for the most probable distribution of the particle of a system obeying B-E statistics. **8**

OR

c) Discuss the behavior of ideal Bose gas below and above Bose temperature. **8**

d) Show that for photon the mean pressure (P) is related to total energy (E) by the relation $< P >= \frac{1}{3}\frac{< E >}{V}$. **8**

Either:

3. a) Show that measure of degeneracy of an ideal strongly degenerated fermi gas is given by: **8**

$$\frac{1}{D} = \frac{h^2}{2m\,KT}\left(\frac{3n}{4\pi V g_s}\right)^{2/3}$$

b) Discuss the electronic specific heat for free electrons in metals using ideal fermi model. **8**

OR

c) Solve the following numerical:

i) Find the fermi energy in eV of copper on the assumption that each copper atom contributes one free electron to the gas **4**

Density of copper $= 8.94 \times 10^3 \text{ kg/m}^3$

Mass of electron $= 9.11 \times 10^{-31} \text{ kg}$

No. of electron per unit volume $= 8.48 \times 10^{28} \text{ e/m}^3$

ii) The no. of conduction electron per c.c. in Beryllium is 24.2×10^{22} and in Cesium is 0.91×10^{22}. If the fermi energy of conduction electron in Beryllium is 14.44 eV calculate fermi energy of conduction electron in Cesium. **4**

d) Discuss cluster expansion for classical gas system. **8**

Either:

4. a) What is Brownian motion & Explain Langevin theory of Brownian motion of particles. **8**

b) Discuss phase transition of first and second order. **8**

OR

c) Explain Landau theory of phase transition. **8**

d) Explain the terms: **8**

i) Order parameter ii) Critical exponents

iii) Scaling hypothesis iv) Random walk

5. Attempt all the followings.

a) Discuss the term macrostate and microstate with the help of examples. **4**

b) Explain Boltzmann limit of Bosons and Fermions. **4**

c) Derive virial equation of state. **4**

d) What is Ising model. **4**

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