

M.Sc. F.Y. (Physics) (CBCS Pattern) Semester-II  
**PSCPHYT06 - Core Paper-VI - Statistical Physics**

P. Pages : 2

Time : Three Hours



**GUG/S/25/11221**

Max. Marks : 80

- Notes : 1. All questions are compulsory.  
2. Draw neat labelled diagram wherever necessary.

**Either:**

1. a) What is Fluctuation? Obtain an expression for mean square fluctuation of energy in grand-canonical ensemble. 8
- b) Define partition function and calculate it's value for diatomic gas molecule. 8

**OR**

- e) State and prove Liouville's theorem. 8
- f) What is Gibb's Paradox? Show that how it can be removed if: 8

$$S = NK \left\{ \ln \left( \frac{V}{N} \right) + \frac{5}{2} + \frac{3}{2} \ln \left( \frac{2\pi mKT}{h^2} \right) \right\}$$

**Either:**

2. a) Explain Bose-Einstein condensation, and also explain limiting case of B.E. Statistics. 8
- b) Show that for photon the mean pressure  $\langle P \rangle$  is related to total energy (E) by the relation: 8

$$\langle P \rangle = \frac{1}{3} \frac{\langle E \rangle}{V}.$$

**OR**

- e) Explain the symmetry of wave function for quantum particles. 8
- f) Derive the relation:  $EF_0 = \frac{h^2}{2m} \left( \frac{3n}{8\pi} \right)^{2/3}$  where, letter's have their usual meaning. 8

**Either:**

3. a) Obtain virial equation of state in terms of cluster integral. 8
- b) Show that the measure of degeneracy of ideal fermi system is given by: 8

$$Z = \frac{1}{D} = \frac{\rho}{g} \left[ \frac{h^2}{2\pi MKT} \right]^{3/2}$$

**OR**

- e) Discuss the concept of an electronic specific heat in detail. 8
- f) Define Fermi function and fermi energy? Obtain an expression for fermi energy at absolute zero temperature. 8

**Either:**

- 4. a) What is Brownian motion and explain Langevin theory of Brownian motion of particles. 8
- b) What is Ising model? Discuss Ising model for phase transition of second order. 8

**OR**

- e) Obtain Fokker – Plank equation for Brownian motion. 8
- f) Discuss the first order phase transition and obtain Clausius-Clapeyron equation. 8

5. Attempt all the followings:

- a) Discuss the terms : (i) Microstate & (ii) Macrostate 4
- b) Explain Boltzmann limit of Bosons & Fermions. 4
- c) What is weak and strong degeneracy. 4
- d) Explain the terms: 4
  - i) Order parameter and
  - ii) Scaling hypothesis

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