

Mid-West University
Examinations Management Office

End Semester Examinations-2080

Master level/ M.Sc.(Physics)/2nd Semester

Time: 3 hours

Subject: Statistical Mechanics (PHY553)

Full Marks: 37.50

Pass Marks: 18.75

Candidates are required to give their answer in their own words as far as Practicable. The figures in the margin indicate full marks.

Attempt all the questions:

1. Describe the thermodynamic behaviour of ideal Bose gas in terms internal energy, pressure and specific heat capacity. Prove that Bose-Einstein condensation is first order phase transition. [6+4]

2. Explain about different types of ensemble? The entropy of an ideal monoatomic gas is given

by,
$$S(E, V) = NK_B \left[\log \left\{ V \left(\frac{4\pi m E}{3N h^2} \right)^{3/2} \right\} \right]$$

Explain the paradox found by Gibb's in the expression of entropy of an ideal monoatomic gas with correction made by him. Then, obtain expression for internal energy, temperature and specific heat capacity with the help of corrected expression of entropy.

OR

Define partition function? Write the importance of partition function in statistical mechanics? Discuss the fluctuation of energy in grand canonical and canonical ensemble. [10]

3. Write fundamental postulates of quantum statistical mechanics? Explain time evolution properties of density matrix? Hence show that density matrix commutes with Hamiltonian operator.

OR

Derive an expression of magnetic susceptibility for an electron in an external magnetic field and show that, $\chi \propto \frac{1}{T}$, where symbol have usual meaning. [5]

4. Calculate the fermi energy of electron in copper and estimate the fraction of electron excited above fermi level at 300 K. (Given, $n = 10^{28} \text{m}^{-3}$). [5]
5. Explain one dimensional Ising Model for determination of energy. [5]
6. Write down differences between phase transition of first and second kind?

OR

Define ensemble average and statistical equilibrium. [2.5]

The End