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M.Sc. (Physics) (Semester-1st)

STATISTICAL PHYSICS

Subject Code: MSPHYS 1102

Paper ID: 18220702

Time: 03 Hours **Maximum Marks: 60**

Instructions to Candidates:

1. Section A is compulsory. It carries 16 Marks. It consists of 4 questions of 4 marks each.
2. Section B consist of 4 questions of 08 marks each. The student has to attempt any 3 questions
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section –A **(4 marks each)**

Q1. Explain macroscopic and microscopic states.

Q2. Compare microcanonical, canonical and grand canonical ensemble.

Q3. Describe the thermodynamic behavior of an ideal Bose gas.

Q4. Write a brief note on random walk in one dimension.

Section –B **(8 marks each)**

Q5. State and prove Liouville's theorem.

Q6. Show that the entropy of a system in the grand canonical ensemble can be written as

$$S = -K \sum_{r,\ s} P_{r,s} \ln ln\, P_{r,s}$$

Q7. Discuss the Bose-Einstein condensation and show that number of particle state equal to $n = g_s Z_i .\ 2.612\left(\frac{T_0}{T}\right)^{3/2}$

Q8. What are the phase transitions of first and the second kind? Discuss Ising Model in the zeroth approximation.

Section –C **(10 marks each)**

Q9. (a) Show that for an ideal gas represented by a grand canonical ensemble, the probability of finding the subsystem within atom is given by Poisson distribution $\omega(n) = \frac{1}{n!}(\overline{n})^{n} exp.(-\overline{n})$ where n is the mean number of atoms present.

(b) How the paradox of Gibbs is resolved in mixing of two gases, explain it?

Q10. What do you mean by ideal Fermi system and explain its thermodynamic behavior.

Q11. (a) Discuss Brownian motion as an example of fluctuating force using Fokker-Plank equation.

(b) Explain the contact between statistics and thermodynamics.