M.Sc. DEGREE EXAMINATION,NOVEMBER 2019
II Year III Semester
Statistical Mechanics

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. State Gibb's phase rule.
2. What are order parameters?
3. State the significance of micro-canonical ensemble.
4. Define entropy and give its significance in phase transition phenomena.
5. What is a trajectory in phase-space?
6. Distinguish between canonical and grand canonical ensembles on the basis of their applicability in real situation.
7. State the principle of Maxwell-Boltzmann statistics.
8. What are ideal gases? Give an example.
9. Give the assumption of Ising model.
10. Define fluctuation.
11. Distinguish between first and second order phase transitions.
12. What is the importance of statistical mechanics among other mechanics?

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. State third law of thermodynamics. Explain why absolute zero is not attainable.
14. Establish the connection between statistics and thermodynamics by proving, $s = Kln\Omega$.
15. (i) Show that the measure of energy fluctuation of a system in the canonical ensemble is kT^2C_v. (ii) Prove that the mean fractional fluctuation is negligible for a system with large number of particles.
16. Obtain the equilibrium distribution for particles obeying Fermi-Dirac statistics.
17. Prove that one dimensional Ising model cannot be ferromagnetic.
18. Explain Liouville's theorem.
19. Derive Planck's law of radiation law from the Bose-Einstein distribution law.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. Explain how phase transitions are discussed by Landau through order parameter.
21. Demonstrate Gibb's paradox with an example of mixing of (i) two different ideal gases and (ii) one ideal gas with same ideal gas. How is paradox resolved?
22. Demonstrate that the density of a group phase points does not dispersed.
23. Explain with necessary theory of Bose - Einstein condensation. Discuss the result in the limit (i) $T < T_b$ and (ii) $T > T_b$, where T_b is the critical temperature.
24. Obtain Langevin equation for Brownian motion and solve.

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