23P208 (Pages: 2) Name: .....

Reg.No: .....

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2024

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19P PHY2 C07 - STATISTICAL MECHANICS

(Physics)

(2019 Admission onwards)

Time : 3 Hours Maximum : 30 Weightage

Section A

Answer ***all*** questions. Each question carries 1 weightage.

1. Differentiate between microstate and macrostate with reference to an ensemble.
2. Write the expression which shows the entropy of a physical system is solely and completely determined by the probability values of its accessible dynamical states. What conclusions can be derived from it?
3. State Equipartition theorem.
4. Write an expression for grand partition function and explain the terms.
5. What is occupation number?
6. Consider a system of 3 fermions which can occupy any of the four available energy states with equal probability. What is the entropy of the system?
7. Explain the onset condition for Bose Einstein condensation.
8. Write a short note on specific heat of electron gas in metals.

(8 × 1 = 8 Weightage)

Section B

Answer any ***two*** questions. Each question carries 5 weightage.

9. State and prove Liouville's theorem. Discuss the consequences of the theory.
10. Obtain thermodynamics of classical ideal gas considering the system as the member of microcanonical ensemble.
11. Obtain Debye’s law for phonons.
12. Obtain the general expression for paramagnetic susceptibility of ideal fermi gas. Discuss the nature of susceptibility at low and high temperature.

(2 × 5 = 10 Weightage)

Section C

Answer any ***four*** questions. Each question carries 3 weightage.

13. What is meant by Gibbs paradox and how it is resolved?

14. Derive the canonical partition function of a classical ideal gas consisting of N identical monatomic molecules confined to a volume V and in equilibrium at temperature T and hence obtain an expression for its entropy.

15. How can an essential link be provided between the thermodynamics of a given system and the statistics of the corresponding grand canonical ensemble?

16. Derive the expression for the expectation value of a physical quantity G.

17. Discuss the statistics of occupational number for the three distributions and show that they converge to the same value in the classical limit.

18. Discuss the thermodynamics of the Black body radiation briefly.

19. 'Even at absolute zero, the Fermi system is quite live'. Explain.

(4 × 3 = 12 Weightage)

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