K25P 1904

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree (C.B.C.S.S. – OBE-Reg./Supple./Imp.) Examination, April 2025
(2023 and 2024 Admissions)
PHYSICS/PHYSICS WITH COMPUTATIONAL AND NANO SCIENCE SPECIALIZATION PROGRAMME
MSPHY02C09/MSPHN02C09 : Statistical Mechanics

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **any 5**. **Each** one carries **3** marks.

1. Explain the physical significance of phase space.
2. How does the grand canonical ensemble differ from the canonical ensemble ?
3. Discuss the role of chemical potential in the grand canonical ensemble.
4. What conditions must be met for Bose-Einstein condensation to occur in an ideal Bose gas ?
5. Explain Fermi temperature and Fermi energy.
6. What is an order parameter, and how does it characterize phase transitions ?

(5×3=15)

SECTION – B

Answer **any 3**. **Each** one carries **6** marks.

7. Why does the Gibbs paradox arise when considering the mixing of identical gases ?
8. Evaluate the relative fluctuations in the energy E of a system in the grand canonical ensemble.

P.T.O.

9. Discuss the case of quantum mechanical oscillators and show that they do not obey the equipartition theorem.

10. Discuss the statistics of mean occupation number.

11. Define critical exponents. Give their significance in phase transitions. **(3×6=18)**

SECTION – C

Answer **any 3**. **Each** one carries **9** marks.

12. Derive various thermodynamic properties of classical ideal gas composed of monoatomic molecules.

13. Explain the following theorems :
    a) Virial theorem
    b) Equipartition theorem.

14. Discuss the behaviour of an ideal Fermi gas. How do quantum effects shape its thermodynamic properties ?

15. Explain the thermodynamics of blackbody radiation.

16. Using the mean field theory, compute the average magnetization for both microcanonical and canonical ensembles. **(3×9=27)**
