D 140703 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2026

(CBCSS)

Physics

PHY2C07—STATISTICAL MECHANICS

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

Section A

(8 *Short questions answerable within* 7½ *minutes*).

Answer **all** *questions, each carries weightage* 1.

1. What is meant by phase space ?
2. Define Ensemble and briefly explain various types.
3. What is a partition function ?
4. State Fermi- Dirac Distribution law ?
5. Briefly explain Gibbs Paradox.
6. Define Bose gas.
7. Explain Equipartition Theorem ?
8. What is a density matrix ?

(8 × 1 = 8 weightage)

Section B

(4 *Essay questions, each answerable within* 30 *minutes*).

Answer any **two** *questions, each carries weightage* 5.

9. What is Micro Canonical Ensemble, Explain the theory of classical ideal gas in Micro Canonical Ensemble formalism.
10. Explain, Paulisthoery of Paramagnetism and get an expression for Suscepibility.

Turn over

11. Outline the features of Bose Statistics and explain Planck's Theory of Black body radiation.

12. Outline the features of quantum mechanical ensemble theory and explain the theory of ideal gas in the quantum mechanical microcanonical ensemble formalism.

(2 × 5 = 10 weightage)

Section C

(7 *Problem questions, each answerable within* 15 *minutes*)

Answer any **four** *questions, each carries weightage* 3.

13. Derive the expression for the Partition function of the Canonical Ensemble ?

14. Get an expression for the density fluctuation of the Grand Canonical Ensemble.

15. Prove with an example that a microstate can have several microstates.

16. Find the nature of the locus of a particle executing a simple harmonic oscillator in phase space?

17. The Fermi energy of Silver is 5.5 eV. Find the average energy of Silver at 0 K.

18. Show that for an ideal Bose gas PV = 2E/3 ?

19. Find the pressure of black body radiation at 400 K and 7000 K.

(4 × 3 = 12 weightage)