(Pages : 2) Name.....

D 102185 Reg. No.....

SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2024

(CBCSS)

Physics

PHY2C07—STATISTICAL MECHANICS

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

Section A

Short questions answerable within 7½ minutes.

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

1. What are the consequences of Liouville's theorem ?
2. Describe how energy fluctuates in the Canonical Ensemble ?
3. What do you mean by the terms Phase space and Ensemble.
4. Write down the partition functions of Canonical and Grand canonical ensembles.
5. What is Gibbs Paradox ?
6. Define Fermi gas.
7. Explain Virial Theorem.
8. Outline the features of Landau's diamagnetism.

(8 × 1 = 8 weighage)

Section B

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

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

9. Differentiate between microstates and macrostates. Derive an expression for the entropy of classical ideal gas.
10. Explain quantum mechanical ensemble theory. Explain the density matrix.
11. Explain the thermodynamic behaviour of the ideal Bose gas. What is the condition for the onset of bose condensation ?
12. Define Fermi Temperature and Fermi Energy. Explain Pauli's story of paramagnetism.

(2 × 5 = 10 weightage)

Turn over

Section C

7 Problem questions, each answerable within 15 minutes.

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

13. Show that for an ideal Bose gas PV = 2E/3.
14. A Bose gas comprises 5 particles and 4 available energy states. How many macrostates a
15. The Fermi energy of Silver is 5.5 eV. Find the average energy of Silver at 0 K.
16. Find the pressure of black body radiation at 500 K and 8000 K.
17. Find the average number of photons in an enclosure of 22.4 litres at 273 K.
18. Find the partition function of an ideal gas in a Canonical ensemble.
19. A system of N noninteracting and distinguishable particles of spin 1 is in thermodynamic eq Find the entropy of the system.

(4 × 3 = 12