

(FOR THE CANDIDATES ADMITTED
DURING THE ACADEMIC YEAR 2025-26 ONLY)

SUBJECT CODE **25 PPS 103**
REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI
END-OF-SEMESTER EXAMINATIONS : NOVEMBER – 2025
M.Sc. – PHYSICS
SEMESTER : I
MAXIMUM MARKS: 75
TIME : 3 HOURS

STATISTICAL MECHANICS

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS. (K1)

1. Canonical ensemble corresponds to system at constant ____.
(a) E, V, N (b) T, V, N (c) P, T, N (d) G, T, P
2. The Maxwell–Boltzmann distribution applies to ____.
(a) indistinguishable particles (b) distinguishable particles (c) fermions (d) bosons
3. Bosons obey ____.
(a) Maxwell–Boltzmann statistics (b) Fermi–Dirac statistics
(c) Bose–Einstein statistics (d) None
4. Bose–Einstein condensation occurs at ____.
(a) high T (b) low T (c) high density (d) both (b) & (c)
5. In one-dimensional Ising model, the interaction is considered only between.....
(a) Next-nearest neighbors (b) Nearest neighbors
(c) All particles (d) Random spins

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)

6. What is a phase cell?
7. Define microstate and macrostate.
8. What is indistinguishability in quantum statistics?
9. Define photon gas.
10. Write one use of Bragg–Williams approximation.

SECTION – B (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K3)

11. a) Explain the postulate of equal a priori probability

(OR)

b) Derive the expression for Gibbs free energy in terms of partition function.
12. a) State and explain the principle of equipartition of energy.

(OR)

b) Explain the effect of shifting zero level of energy on partition function.

(CONTD 2)

13. a) Discuss the transition from classical to quantum statistical mechanics.

(OR)

- b) Differentiate between symmetric and antisymmetric wave functions.

14. a) Explain the properties of liquid helium.

(OR)

- b) Derive the expression for free electron gas model.

15. a) Discuss the Ising model in detail.

(OR)

- b) Derive the expression for energy fluctuations.

SECTION – C

(5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) State and prove Liouville's theorem in statistical mechanics.

(OR)

- b) Mention various types of ensembles and discuss their role in statistical mechanics.

17. a) Describe the theory of Maxwell–Boltzmann distribution law and deduce the expressions for most probable value.

(OR)

- b) Discuss Gibbs paradox and its resolution.

18. a) Explain the concept of density matrix and its applications in quantum statistics.

(OR)

- b) Discuss Bose–Einstein distribution law and deduce the derivations.

19. a) Derive Planck's radiation law for black body radiation associated with it and discuss.

(OR)

- b) Explain Einstein's theory of specific heat of solids and discuss the limitations.

20. a) Explain the theory of Brownian motion and give a note on Onsager solution..

(OR)

- b) Explain first-order and second-order phase transitions in Ising Model.
