

KAMARAJ COLLEGE (Autonomous)

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

THOOTHUKUDI – 628 003

(5 Pages)

Reg. No:

Question. Code No : 25E03301

Sub Code : 24PMPH21

PG Degree - End Semester Examinations, April 2025

Second Semester

M.Sc. PHYSICS

Major - Statistical Mechanics

(For those who joined in July 2024 onwards)

Time : 3Hours

Maximum : 75 Marks

PART – A ($10 \times 1 = 10$ Marks)

Answer ALL Questions

Choose the correct answer :

1. The number of most probable microstates for a system having odd number of particle is
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 4

2. The phase space is combination of ----- space.
- (a) Position and momentum (b) Position and moment
(c) Moment and velocity (d) Moment and
momentum
3. Gibb's paradox is that if systems are completely identical but distinguishable then for combine systems
- (a) Entropy is not additive
(b) Entropy is multiplicative
(c) Entropy is additive
(d) Entropy becomes zero
4. The ensemble in which both energy and the number of particles can be exchanged with the reservoir is called
- (a) Canonical Ensemble (b) Microcanonical
Ensemble
(c) Grand Canonical Ensemble (d) None of these
5. Bose-Einstein statistics applies to
- (a) electrons (b) molecules
(c) photons (d) All of the above
6. Planck's radiation law can be derived by using
- (a) Maxwell's Boltzmann (b) Fermi-Dirac statistics
statistics
(c) Bose-Einstein statistics (d) All of the above

7. Using adiabatic demagnetisation, the minimum temperature produced is
- (a) 10K (b) 1K
(c) 0.25K (d) 0K
8. The fluctuation in a parameter is measured by
- (a) Mean value (b) Mean square value
(c) Mean square deviation (d) None of these
9. Conversion of boiling water at 1 atmosphere and 100 °C in vapour is an example of
- (a) Zero order phase transition
(b) First order phase transition
(c) Second order phase transition
(d) Third order phase transition
10. The Landau function for parameter x at given temperature usually has
- (a) One root only (b) Two roots only
(c) Three roots only (d) Unique value

PART – B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

11. (a) Write the fundamental postulates of statistical mechanics.

(OR)

(b) Explain about Micro and Macro states.

12. (a) Explain the physical significance of the micro canonical ensemble of an Isolated System.

(OR)

(b) Calculate the volume in the phase space for a harmonic oscillator.

13. (a) Write a detailed note on Bose-Einstein's condensation.

(OR)

(b) Define blackbody radiation and deduce an expression for Plank's radiation law.

14. (a) Give the method of production of low temperature.

(OR)

(b) Write a note on fluctuations in energy and pressure.

15. (a) Explain the four thermodynamic potentials V, F, H and G

(OR)

(b) What do you mean by first order phase transitions? How it can be characterised?

PART – C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 600 words.

16. (a) Discuss the probability distribution and entropy of a two level system.

(OR)

- (b) State and prove Liouville's theorem.

17. (a) Define partition function. Discuss how the thermodynamic functions of microcanonical ensemble are calculated from it.

(OR)

- (b) Explain the applications of Grand canonical ensemble.

(i) Brownian Motion

(ii) Mean kinetic energy of a molecule of a gas.

18. (a) Discuss about the Debye's theory of specific heat of solids. Find the specific heat at constant volume.

(OR)

- (b) Explain the difference between Bose Einstein and Fermi Dirac statistics.

19. (a) Discuss the principle, method and theory of production of absolute zero by adiabatic demagnetisation.

(OR)

- (b) Derive the Fokker-Planck equation representing the motion due to fluctuating force.

20. (a) Discuss Landau's theory of phase transition.

(OR)

- (b) Explain the Ising model for one dimension