Reg. No. :

Code No.: 6035 Sub. Code: PPHM 33

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2021

Third Semester

PHYSICS - CORE

## STATISTICAL MECHANICS

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A —  $(10 \times 1 = 10 \text{ marks})$ 

Answer ALL questions.

Choose the correct answers :

- 1. Phase space is divided into
  - (a) Groups (b) Subgroups
  - (c) Sets (d) Cells

(6 Pages)

- 2. Thermodynamics probability of a macro state is
  - (a) Number of particles
  - (b) Number of cells
  - (c) Number of systems
  - (d) Number of accessible microstates
- 3. All micro state are equally probable for a given microstate is called
  - (a) Statistical postulate
  - (b) Thermodynamic postulate
  - (c) Postulate of equal a priori probability
  - (d) Postulate of equality
- 4. Number of cells in 2f dimensional phase space is
  - (a) 2f (b) f
  - (c) 6f (d) None of the above
- 5. Bose Einstein statistics applies to
  - (a) Electrons (b) Molecules
  - (c) Photons (d) All the above
    - Page 2 Code No. : 6035

- 6. In quantum statistics the particle are
  - (a) Identical and distinguishable
  - (b) Identical and indistinguishable
  - (c) Molecules only
  - (d) Photons only
- 7. Which of the following is a Boson?
  - (a) Alpha particle (b) Neutron
  - (c) Positron (d) Proton
- 8. In Debye's model of vibrations of solid the minimum wavelength is equal to
  - (a) a (b)  $a^2$
  - (c) 2a (d)  $\sqrt{a}$
- 9. An ideal gas is one in which there is
  - (a) Strong interaction (b) No interaction
  - (c) Weak interaction (d) All the above
- 10. Which of the following represents a first order phase transitions?
  - (a) Onset of ferro electricity
  - (b) Super conductivity
  - (c) Order disorder transition in alloys
  - (d) Sublimation

Page 3 Code No. : 6035

PART B —  $(5 \times 5 = 25 \text{ marks})$ 

Answer ALL questions, choosing either (a) or (b) Each answer should not exceed 250 words.

11. (a) Explain the density of distribution in phase space.

Or

- (b) Explain canonical and grand canonical ensemble.
- 12. (a) Distinguish the micro states from macro states.

Or

- (b) Discuss in detail general statistical distribution law.
- 13. (a) Explain Bose Einstein statistics in detail.

Or

- (b) Compare Maxwell Boltzmann, Fermi Dirac and Bose – Einstein statistics.
- 14. (a) Discuss in detail energy and pressure of the gas.

 $\mathbf{Or}$ 

(b) Describe the Einstein theory of specific heat of solids.

Page 4 Code No. : 6035

[P.T.O]

15. (a) Explain the phase transitions of the second kind.

 $\mathbf{Or}$ 

(b) Discuss the Braggs – Williams approximation.

PART C —  $(5 \times 8 = 40 \text{ marks})$ 

- Answer ALL questions, choosing either (a) or (b) Each answer should not exceed 600 words.
- 16. (a) Explain in detail statistical and thermal equilibriums.

Or

- (b) Obtain the connection between statistical and thermo dynamical quantities.
- 17. (a) Obtain Maxwell Boltzmann law of distribution of molecular velocities.

 $\mathbf{Or}$ 

- (b) Derive Boltzmann's entropy relation.
- (a) Give the theory of block body radiation and the Planck radiation law.

Or

(b) Explain Fermi – Dirac statistics.

Page 5 **Code No. : 6035** 

19. (a) What do you mean by Bose – Einstein condensation? Explain in detail.

## Or

- (b) Considering the free electron in a metal to form a Fermi gas, obtain Richardson – Dushman equation for thermionic emission for electrons.
- 20. (a) Briefly explain the one dimensional Ising model.

Or

(b) Describe the Yang and Lee theory.

Page 6 **Code No. : 6035**