WA-5325

M. Sc. (Sem. II) Examination, June - 2024

PHYSICS

PAPER - PHY-2001

STATISTICAL MECHANICS

Time Allowed : **Three Hours**

Maximum Marks : **70**

Min. Marks : **28**

Note : *This question paper contains two sections as under :*

Section-A ***Max. Marks-20***

This section will have 10 questions, having 02 questions from each unit with no internal choice. Answer in about 20 words. All questions will have equal marks. (10×02=20)

Section-B ***Max. Marks-50***

This section will have 10 questions, having 02 questions from each unit, one question to be attempted from each unit. Words limit approximately 400-500 words. Questions may have sub divisions. All questions will have equal marks. (10×05=50)

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SECTION - A

1 (i) Define phase space.

(ii) Differentiate the thermodynamical and statistical system.

(iii) What do you understand by density fluctuations ?

(iv) Write any two properties of partition function.

(v) Define Random walk.

(vi) What do you understand by order parameter ?

(vii) What do you understand by identical particles ?

(viii) How you differentiate Boson and Fermions?

(ix) Define Fermi Dirac distribution formula and discuss the case when $E < E_F$ where E_F is the fermi energy.

(x) What do you understand by width of the conduction band ?

SECTION - B

UNIT - I

2 Define ensemble and discuss three types of ensemble. Also write a note on the physical significance of ensemble.

OR

Discuss the connection between thermodynamics and statistical quantities.

UNIT - II

3 Discuss thermodynamics functions for the canonical ensemble along with Helmholtz free energy and entropy in terms of it.

OR

Define partition function and discuss the partition function for an ideal gas. Also calculate the average energy of a monoatomic ideal gas.

UNIT - III

4 Determine and discuss the translational, rotational and vibrational contributions to the partition function of an ideal diatomic gas.

OR

Discuss the Landan theory of a first order phase transition.

UNIT - IV

5 Differentiate the Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

OR

Define creation and annihilation of phonon operators and calculate the average value of x^4 in the ground state of oscillation using these operators.

UNIT - V

6 (a) Define and discuss the density of states and also write its physical significance. **7**

(b) Write a note on absorption in metals. **3**

OR

(a) Define electrical conductivity and thermal conductivity and discuss the Widemann-Franz ratio. **3**

(b) Discuss the Drude theory of light propagation in conducting media. **7**
