Roll No...............   **Total No. of Printed Pages : 4**

Code No. : B02/201

Second Semester Online Examination, May-June, 2022

M. Sc. PHYSICS

Paper II

STATISTICAL MECHANICS

Time : Three Hours]   [Maximum Marks : 80

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Note : *Part A and B of each question in each unit consist of 'very short answer type question' which are to be answered in one or two sentences. Part C 'Short answer type' and D 'Long answer type' of each question should be answered within the word limit mentioned.*

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UNIT-I

1. (A) Define thermodynamical probability.   **2**

   (B) Define chemical potential.   **2**

   (C) Compare microcanonical, cannonical and grand canonical ensemble ?

   (word limit 200-250) **4**

OR

Derive expression for chemical potential of a perfect gas in micro-canonical ensemble.

P.T.O.

(D) Define partition function ? Derive partition function and thermodynamic function for a system represented by a grand canonical ensemble ?   *(word limit 400-450)* **12**

OR

How the statistical parameters are used to explain the thermodynamic parameters : entropy, enthalpy. Gibb's free energy and Helmholz's free energy.

UNIT-II

2. (A) State Liouvill's theorem ?   **2**

   (B) What is the difference between classical and quantum statistics ?   **2**

   (C) What do you understand by the term phase space ? Classify different types of phase space ?   *(word limit 200-250)* **4**

OR

Compare the basic postulates of the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics ?

[2]

(D) Discuss the phenomenon of Bose-Einstein condensation. Discuss the anomalous properties of liquid helium at the transition temperature. *(word limit 400-450)* **12**

OR

Define Fermi gas ? Discuss it in terms of strong and weak degeneracy.

UNIT-III

3. (A) Define triple point ? **2**

(B) Write about Ising Model ? **2**

(C) Derive the virial equation for the theory of imperfect gas ?

(word limit 200-250) **4**

OR

Explain Landan theory of first order transition.

(D) Derive equation of state of the system in cluster expension for a classical gas.

(word limit 400-450) **12**

OR

What are phase transition of first and second kind. Give clour distinction between them ? How Yang and Lee theory may be used to explain phase transition ?

UNIT-IV

4. (A) Define Brownian motion. **2**

(B) Write Fokber-Planck equation. **2**

(C) Derive Nernst relation.

(word limit 200-250) **4**

OR

Derive Langevin's theory.

(D) Define fluctuations ? Explain thermodynamic fluctuation.

(word limit 400-450) **12**

OR

Derive Formula for spatial correlation in fluid.

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