S-492

Total Pages : 3   Roll No. ....

MSCPH-504

Statistical Mechanics

M.Sc. Physics (MSCPH)

1st Semester Examination, 2022 (Dec.)

Time : 2 Hours]   **Max. Marks : 70**

Note : This paper is of Seventy (70) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A
(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Nineteen (19) marks each. Learners are required to answer any Two (02) questions only.

$(2×19=38)$

1. Discuss the concept of macrostates and microstates in detail. Using an example of two dices rolled simultaneously, write the number of microstates and macrostates.

2. (a) What are the postulates of statistical mechanics?

(b) What is the thermodynamic probability?

3. Define partition function for a microcanonical ensemble. Use it to derive expressions for chemical potential, Helmholtz free energy, and Gibbs free energy.

4. Derive an expression for grand canonical partition function and hence grand canonical distribution.

5. (a) What do you understand by Fermi Dirac statistics? Find an expression for it?

(b) What do you understand by electrons gas? Show that at normal temperature, the pressure of the gas is sufficiently high.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Eight (08) marks each. Learners are required to answer any Four (04) questions only. (4×8=32)

1. What is ergodic hypothesis?

2. Write down the condition of statistical equilibrium.

3. Calculate the root mean square value of speed of nitrogen molecules (mass of the nitrogen molecule m = 4.6×10^{-26} kg) at 27°C.

4. With the help of pictorial representation define microcanonical ensemble.

5. Prove that energy fluctuations in canonical ensemble are related to the specific heat.

6. Obtain the expression for the chemical potential $\mu(T, P)$ for an ideal gas of non-relativistic particles in a grand canonical ensemble.

7. What do you understand by Bose Einstein statistics? Find an expression for it?

8. What are phase transitions? How Yang and Lee Theory may be used to explain phase transition?

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