SECOND SEMESTER EXAMINATION 2021-22

M.Sc. PHYSICS
Paper - II
Statistical Mechanics

Time : 3.00 Hrs.   **Max. Marks : 80**

Total No. of Printed Page : 03   **Mini. Marks : 29**

Note:- Question paper is divided into three sections. Attempt question of all three section as per direction Distribution of marks is given in each section.

Section 'A'

Very short answer question (in few words)

Q.1   Attempt any six questions from the following :   6x2=12

    (i)   How does the specific heat depends on temperature T of an ideal gas in 3-dimension.

    (ii)   Name the statistics through which plank's radiation can be derived.

    (iii)   Which physical quantity remains constant during the process of phase-transition?

    (iv)   Write one example of first order phase transition.

    (v)   Define quantum liquid.

    (vi)   What is λ-transition ?

    (vii)   How does the fermi gas of a free electrons depends on in terms of electron density ϱ ?

    (viii)   Name the statistics obeyed by photon and electron.

(ix)   What do you mean by density matrix ?

(x)   According to the Fermi-Dirac statistics the numbers of particles in a phase cell can be ....

Section 'B'

Short answer type question (in 200 words)

Q.1   Attempt any four questions from the following :   4x5=20

(i)   State and disucss in brief the zeoth law of thermodynamics.

(ii)   Define thermodynamical probability.

(iii)   What are fundamental postulates statistical mechanics.

(iv)   Define partition function.

(v)   What do you mean b Gibb's paradox ?

(vi)   Show that mean enegry $\overline{E} = -\dfrac{\partial}{\partial \beta} \log z$ where z is partition function, where

$\beta = \dfrac{1}{kT}$.

(vii)   Write the comparison between Eienstein and Fermi Dirac statistics.

(viii)   Explain concept of temperature on the basis of kinetic energy of gases.

Section 'C'

Long answer/Essay type question.   4x12=48

Q.3   Attempt any four questions from the following questions :

(i)   Explain the following :

(a)   Thermodynamic fluctuation.

(b)   Cononical and grand canonical ensembles.

(ii) What do you understand by the term phase space ? Classify different types of phase space. Derive on expression for the number of states in the range E and $E+dE$.

(iii) Define partition function and calculate its value for an ideal monoatomic gas. Obtain expression for pressure and entropy in terms of partition function.

(iv) Explain the following :

    (a) Landau theory of phase transition.

    (b) Langevin's theory

(v) Write short notes on :

    (a) Fermi thoery of free electron gas

    (b) Elementry excitation in liquid He-II

(vi) What is meant by ensembles Discuss types of an ensemble in detail & compare between types of ensemble.

(vii) Explain the following :

    (a) Law of equipartition of energy

    (b) Fluctulation dissipation theorem.

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