GSM/M-20 **1618**

PHYSICS–VII

(Statistical Physics)

Paper–PH-401

Option–II

Time Allowed : 3 Hours] [Maximum Marks : 40

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. Question No. **1** is compulsory.

Compulsory Question

1. (a) Find the number of possible arrangements of two particles in two cells assuming particles obey B.E., F.D., M.B. statistics. 2

   (b) Calculate the most probable speed for the molecules at 27°C, having mass m = 3×10^{-23} gm, k = 1.38×10^{-16} erg/k. 2

   (c) What are the assumptions of Debye Model. 2

   (d) What is Fermi Energy ? 2

UNIT–I

2. (a) For a distribution of n distinguishable particles in two compartments of equal size. Derive the expression for probability of a macrostate $\left(\dfrac{n}{2} + x, \dfrac{n}{2} - x\right)$, where x << n.   5

    (b) From a well shuffled pack of 52 cards, a card is drawn at random. What is the probability that it is an ace or a king ?   3

3. (a) Derive the condition $\beta_1 = \beta_2$ for equilibrium of two systems in thermal contact.   4

    (b) A coin is so loaded that the probability of setting head in a toss is 0.7. Deduce the probability that in 5 tosses we get :

      (i) Two heads and three tails.

      (ii) All heads

      (iii) All tails.   4

UNIT–II

4. Using M-B law of statistics for distribution of speeds. Find the expression for :

    (i) Most probable speed.

1618/K/131   **2**

(ii) Average speed.

(iii) Root mean square speed.

(iv) Relation between above three speeds. 8

5. (a) Derive an expression for the Maxwell-Boltzmann distribution for the molecules in an ideal gas. 6

(b) What are the main points of difference between classical and quantum statistics ? 2

UNIT–III

6. Starting from the basic assumption of F.D. statistics. Derive the relation

$$n_i = \frac{g_i}{e^{\alpha + \beta u_i} + 1}.$$ 8

7. (a) Using B-E statistics, derive Planck's law for black body radiation. 5

(b) Give detailed comparison between the three kinds of Statistics. 3

UNIT–IV

8. Discuss Einstein theory of lattice specific heat of solid and explain why it is not capable of giving correct behaviour at low temperature. 8

9. (a) Derive Dulong and Petit's law for specific heat of Solids. Discuss the result obtained. 6

(b) Discuss the assumption of Einstein theory of lattice specific heat of solids. 2