(i) Printed Pages : 3 Roll No. .....

(ii) Questions : 7 Sub. Code : 1 7 2 4 7

Exam. Code : 0 0 0 3

B.A./B.Sc. (General) 3rd Semester

(2124)

PHYSICS

Paper : A (Statistical Physics & Thermodynamics-I)

Time Allowed : Three Hours] [Maximum Marks : 44

Note :— (1) Attempt FIVE questions in all.

(2) Select at least TWO questions each from Unit-I and Unit-II. Unit-III is compulsory.

(3) Use of non programmable calculator is allowed.

UNIT—I

1. (a) Derive an expression $P(f) = P_{max} e^{-f^2 n/2}$ for a macrostate having a fractional deviation f from the most probable macrostate for a distribution of n distinguishable particles in two identical compartments. 6

(b) Calculator the percentage error in using Stirling's formula in $|nn! = n|nn - n$ where $n = 4$. 3

2. (a) Discuss the distribution of n distinguishable particles in k compartments of unequal size which are further sub divided into cells of equal a priori probability. 6

(b) A bag contains 6 green balls, 8 white balls and 10 black balls. If a ball is drawn from the bag, what is the probability of its being either white or black ? 3

3. (a) What do you mean by most probable macrostate ? Derive an expression for the probability of this state corresponding to distribution on N-particles in two identical compartments. 6

(b) A box is divided into two equal halves and 200 molecules are enclosed in the box which freely move in the box from one half to the other. Calculate the ratio of the time spent in the state (105,95) and the most probable state. 3

UNIT—II

4. (a) Discuss Maxwell-Boltzmann statistics distribution and derive MB distribution relation in terms of α and β. 6

(b) Describe the basic assumptions in the three types of statistics. 3

5. (a) Derive Planck's law for black body radiation. Obtain Wein's displacement law and Stefan's law from this law. 7

(b) The radius of Sun is 6.96×10^5 km. Its surface temperature is 6000 K. Find the amount of energy radiated by it in one second. Given $\sigma = 5.67 \times 10^{-8}$ w $m^{-2}x^{-4}$. 2

6. (a) Define Fermi energy and derive an expression for it for free electrons in the conductor. 7

(b) Fermi energy of silver is 5.51ev. Calculator (i) The average energy of free electron in silver at 0K (ii) The average of an electron with this energy. 2

UNIT—III

7. Attempt any **eight** parts :

(i) What is meant by (a) meaningful (b) meaningless arrangements ?

(ii) How does classical statistics differ from quantum statistics ?

(iii) Do electrons have zero energy at 0K ? If not, explain why.

(iv) What is occupation index ? What is its functional form at T = 0K for a system of fermions ?

(v) Explain the term constraints on a system.

(vi) What is the range of probability of an event ?

(vii) What is the meaning of the principle of equal a priori probability ?

(viii) What is the wave length at which the human body radiates maximum energy ?

(ix) Define Rayleigh Jean's law.

(x) What in the difference between Photon gas and Ideal gas ? $1 \times 8 = 8$