(i) Printed Pages :4]

Roll No. ....

(ii) Questions   :7]

Sub. Code : | 0 | 2 | 4 | 7 |

Exam. Code: | 0 | 0 | 0 | 3 |

B.A./B.Sc. (General) 3rd Semester Examination
1127
PHYSICS
(Statistical Physics and Thermodynamics-I)
Paper : A

Time : 3 Hours]   **[Max. Marks : 44**

Note :- (i) Attempt five questions in all, selecting two questions each from Unit I and Unit II. Unit III is compulsory.

(ii) Use of logarithmic tables and non-programmable calculator is allowed.

Unit-I

1. (a) What is thermodynamic probability for distributing 'n' distinguishable particles in two compartments ? Find the probability of a macrostate, most probable macrostate and least probable macrostate.   6

(1)

(b) A bag contains 6 white and 8 red balls. Three balls are taken out of the bag one by one in a random fashion. Calculate the probability of all the three balls to be red. 3

2. (a) Discuss the variation of probability of a macrostate on account Of deviation from the state of maximum probability for a system of 'n' particles in two compartments of equal probability. 7

(b) If a pair of six faced dice with faces marked 1 to 6 is thrown, what is the probability that sum of numbers which show up is 8. 2

3. (a) Prove that for a dynamic system, the fraction of total time spent in any particular macrostate is proportional to the thermodynamic probability of that state. 6

(b) Calculate the percentage error in using Sterling's formula in $\ln n! = n \ln - n$, where $n = 4$. 3

Unit-II

4. (a) Explain the term position, space, momentum Space and Phase space. 3

(2)

(b) For any classical system occupying volume 'v' derive an expression for the number of phase space cells in the momentum interval 'p' to 'p + dp' and energy interval 'u' to 'u + du'. 6

5. (a) What are the assumptions of Bose-Einstein Statistics ? Derive the Bose-Einstein distribution law. 6

(b) Show that Wein's displacement law can be obtained from Planck's law. 3

6. (a) What is the difference between Maxwell Boltzmann, Bose-Einstein and Fermi Dirac Statistics ? Give at least six differences. 6

(b) At what temperature will the average speed of molecule of hydrogen gas be double the average speed of oxygen gas molecule at 300 K ? 3

Unit-III

7. Attempt any eight questions. Each question carries 1 mark.

(a) What is the probability of drawing a king from a deck of 52 cards ?

(b) What is the value of occupation index of fermions at $0°K$ for $U > U_f$ and $U < U_{f'}$,

where U_f denotes the fermi energy ?

(c) What is the difference between microstate and macrostate

(d) Explain the term constraints on a system.

(e) What is the difference between fermions and Bosons

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

(g) How does free electron gas differ from an ordinary gas ?

(h) Under what conditions do Bose-Einstein and Fermi Dirac Statistics lead to classical statistics

(i) What is the minimum size of phase space cell in classical and quantum statistics

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

$8 \times 1 = 8$