(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

(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 $lnn! = nln - n$, where $n = 4$. 3

Unit–II

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

   (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 ?

8×1=8