Exam. Code : 103203
Subject Code : 1355

B.A./B.Sc. 3rd Semester
PHYSICS
Paper—A
(Statistical Physics & Thermodynamics)

Time Allowed—Three Hours]   [Maximum Marks—35

Note :— Attempt **FIVE** questions in all, selecting **ONE** question from each of the Sections B, C, D and E. Section A is compulsory. Log tables can be asked for if necessary.

SECTION—A (Compulsory)

1. (a) A card is drawn from a well shuffled pack of cards. Calculate the probability for this card not to be a King.

    (b) What do you mean by a macrostate and a microstate ?

    (c) Give main differences between B.E. and F.D. statistics.

    (d) What do you understand by internal energy of a system ?

    (e) Giving an example, explain reversible process.

(f) What do you mean by adiabatic process ?

(g) What do you mean by specific heat of a substance ? Give its cgs units. $1 \times 7 = 7$

SECTION—B

2. Taking the case of n particles distributed in two compartments with equal a priori probability, discuss the variation of probability of a macrostate on account of small deviations from the state of maximum probability. 7

3. (a) Discuss the distribution of four different particles in two compartments of equal sizes. Write the microstates, macrostates and their probability.

4

(b) Calculate the total number of ways of arranging four distinguishable particles in three compartments. 3

SECTION—C

4. Taking ideal gas as a system governed by classical statistics, derive the Maxwell-Boltzmann law of distribution of molecular energies and law of distribution of speeds. 7

5. (a) Starting with the basic assumptions, derive the Bose-Einstein distribution law. 5

(b) Compare M-B and B-E statistics. 2

142(2116)/RRA-4375   **2**   (Contd.)

SECTION—D

6. What is a Carnot's heat engine ? Derive an expression for the efficiency of the Carnot's heat engine, using one mole of an ideal gas as the working substance. How will you find maximum efficiency of a steam engine from it ? 7

7. (a) What is law of increase of entropy ? What is its importance in natural processes ? Discuss any two applications of this law. 5

   (b) Explain disorder. 2

SECTION—E

8. (a) Define specific heats at constant volume and constant pressure. 1

   (b) Find an expression for $(C_p - C_v)$ for a van der Waal's gas, where the letters have their usual meanings. 4

   (c) Discuss mathematically variation of C_p with pressure. 2

9. (a) Write down Maxwell's thermodynamic relations. Discuss the following two applications of these relations. 3

   (b) Find the change in temperature of a substance when it is compressed adiabatically. 2

   (c) Show that the temperature of a perfect gas increases during adiabatic compression. 2

142(2116)/RRA-4375   3   6800