Exam. Code : 103203
Subject Code : 1304

B.A./B.Sc. 3rd Semester (Batch 2020-23)

PHYSICS

Paper—A (Statistical Physics & Thermodynamics)

Time Allowed—3 Hours] [Maximum Marks—35

Note :— Attempt ***five*** questions in all, selecting at least ***one*** question from each section. **Fifth** question may be attempted from any section. Log tables can be asked for if necessary.

SECTION—A

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

2. Four distinguishable particles are to be distributed among two compartments. The first compartment is divided into 3 cells and second into 2 cells. All the cells are of equal a priori probability and there is no restrictions on number of particles that can go into any cell. Calculate the values of W(4,0), W(3,1), W(2,2), W(1,3), W(0,4). 7

SECTION—B

3. Treating ideal gas as a system governed by classical statistics, derive the Maxwell-Boltzmann law of distribution of molecular speeds. 7

4. Starting from the basic postulates, obtain the Fermi-Dirac distribution law. 7

SECTION—C

5. Discuss the thermodynamics of a thermocouple. Derive an expression for (dE/dT) and (d^2E/dT^2) for a thermocouple, where E and T have their usual meanings. 7

6. Derive an expression for the efficiency of the Carnot's heat engine, using one mole of an ideal gas as the working substance. 7

SECTION—D

7. (a) Derive an expression for $(C_p - C_v)$ for van der Waal's gas. 5

   (b) Why does a rubber string heat up on stretching ? 2

8. Starting from four thermodynamical potentials, derive Maxwell's thermodynamic relations. 7