Exam. Code : 103203
Subject Code : 1360

B.A./B.Sc. 3rd Semester

PHYSICS PAPER–A

(Statistical Physics and Thermodynamics)

Time Allowed—3 Hours] [Maximum Marks—35

Note :– Attempt **five** questions in all, selecting **one** question each from Sections B, C, D and E. Section A is compulsory. Log tables can be asked for if necessary.

SECTION–A

1. (i) What is meant by meaningful and meaningless arrangements ? Give example.
   (ii) A card is drawn from a well shuffled pack of cards. What is the probability that is either a king or ace ?
   (iii) What do you understand by Fermi-Energy level of a metal ?
   (iv) If we look into Ferry's black body through the opening, what will be its colour ?
   (v) Give statistical definition of entropy.
   (vi) What is heat death of universe ?
   (vii) Define temperature of inversion. 1×7

SECTION–B

2. (a) In a system, 8 distinguishable particles are distributed in two compartments with equal a priori probability. Calculate the probabilities for the macrostates (4, 4), (3, 5), (2, 6) and (1,7). 4
   (b) Explain the static and dynamic system of particles with the help of examples. 3

3. 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 deviations from the state of maximum probability. 7

SECTION–C

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

5. Apply the Fermi-Dirac distribution law to derive the energy distribution of free electrons inside a conductor. 7

SECTION–D

6. 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

7. 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–E

8. Define internal energy of a system. Give its variation with volume for perfect gas as well as real gas. 7

9. Starting from four thermodynamic potentials, derive the Maxwell's thermodynamic relations. 7