(05/25)

5217

B.Sc. EXAMINATION

(Fourth Semester)

PHYSICS

Paper VII

Statistical Physics

Time : Three Hours   *Maximum Marks* : 40

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory and consists of six short questions and answer should be brief but not in yes/no. All questions carry equal marks. Use of scientific (non programmable) calculator is allowed.

(Compulsory Question)

1. (a) What do you mean by microscopic systems ?   1

    (b) Define Phase Space.   1

    (c) What is Zero point energy ?   1

    (d) Discuss about constraints.   2

    (e) What is Fermi temperature ?   1

    (f) Discuss about the Debye temperature.   2

Unit I

2. (a) Describe the distributions of four distinguishable and indistinguishable particles in two boxes of equal size.   5

    (b) A bag contain 6 white balls and 5 black balls. Three balls are pulled out of the bag one by one randomly. Calculate the probability of all the three balls to be black.   3

3. (a) What is condition of equilibrium between two systems in thermal contact, discuss in detail ?   5

(b) In a system of eight distinguishable particles distributed in two equal sized compartments, calculate the probability of macrostate (6, 2).   3

Unit II

4. (a) Explain in detail the Maxwell-Boltzmann energy distribution law in case of an ideal gas.   5

    (b) For oxygen gas at 27°C, calculate most probable speed of oxygen molecules. [Take $k = 1\cdot38 \times 10^{-16}$ erg/ K, molecular weight of nitrogen = 32 g mol^{-1} Avogadro number = 6.023×10^{23}/mole].   3

5. (a) Assuming Maxwell distribution law, calculate average speed of molecules. 5

    (b) Calculate the ratio of respective rms velocities of the gas molecules at 227°C and 327°C.   3

Unit III

6. Discuss Fermi Dirac Energy distribution law in detail. 8

7. Compare the Boltzmann, Fermi-Dirac and Bose-Einstein statistics. 8

Unit IV

8. Discuss in detail the Dulong and Petit law. 8

9. Explain in detail Debye model of specific heat of solids. 8