STATISTICAL PHYSICS AND THERMODYNANICS – I

Time : Three Hours] [Maximum Marks : 40

Note : Attempt *two* questins each from Section A and B carrying 8 marks each Section C is compulsory consisting of 8 short answer type questions carrying 1 mark each.

Section - A

1. Prove that for a dynamic system the fraction of the total time that the system spends in any particular macrostate is proportional to thermodynamic probability for the macrostate. 8
2. (a) Define the terms Microstates, Macrostates, Accessible and Inaccessible states. 4
   (b) Calculate the percentage error made in using Striling formula (n = 5). 4
3. 100 molecules of a gas is enclosed in a cubical volume. Calculate ratio of time spent by system in the most probable macrostate and (49, 51) state. 8
4. (a) Explain the necessity of introducing the concept of a cell. 4
   (b) Determine P (10,0), P (3, 7) for a system of 10 particles in two compartments of equal size. 4

Section - B

5. Calculate the average and root mean square speed of molecules obeying M-B statistics. 8
6. Calculatge the root-mean-square and most probable speed of a gas whose density is 1.4 gm/litre at a pressure of 10^5 N/m². 8
7. Prove that Wein's displacement law and Stefan's law can be obtained from Planck's law. 8
8. Apply F-D statistics of discuss free electrons inside metals. 8

Section - C
(Compulsory Question)

9. Give answer in short :
   (a) What is difference between electron gas and ordinary gas ?
   (b) State the number of consantraints obeyed by a photon gas.
   (c) What is fermi velocity of free electrons in metals ?
   (d) What are permissible values of fractional deviation ?
   (e) Define mutual exclusive events.
   (f) What are meaningful and meaningless arrangements ?
   (g) What are different approaches for describing a given system?
   (h) Define random experiment and event. 8×1=8