

Dr Ravi Shankar

6/12/2022 (127)
(22)

National Institute of Technology Hamirpur

Department of Physics and Photonics Sciences

End Term Examination (December 2022)

B.Tech. 3rd Year (5th Semester)

Statistical Mechanics (PH-313)

M.M.: 50

T.T.: 3hrs

Note: All questions in **Section A** are compulsory. Do any 5 from **Section B**.

(Section A; 10X2=20)

I.. Write your to the following questions in brief.

1. Differentiate between a macrostate and a microstate.
2. Compare microcanonical ensemble and canonical ensemble.
3. Write the differences between a classical ideal gas and quantum ideal gas.
4. Define ensemble average and density function.
5. Discuss grand canonical ensemble in brief.
6. Discuss how BE statistics is different from the FD statistics.
7. Discuss chemical potential of a Bose gas.
8. Justify the non relativistic treatment of electron gas in metals.
9. Discuss the criteria which tells us about the increasingly important role of quantum effects and hence about the need of quantum statistics.
10. Write formula for density of the states for density of states and meaning of each term.

(Section B; 5X6=30)

II. Prove Liouville's theorem.

III. Find the probability P_r that at any time 't' a system in the ensemble is found to be in one of the states having energy E_r .

IV. Derive Curie law of paramagnetism using canonical ensemble theory.

V. For a system of dipoles with $J=1/2$, find the expression for the temperature and entropy.

VI. Find the expression for the density operator used in quantum statistics.

VII. Find the expression for the fraction of particles in ground state as a function of ratio ' T/T_c ' where ' T ' is temperature and ' T_c ' is critical temperature of the Bose gas.