LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

FIRST SEMESTER – NOVEMBER 2016

PH 1810 - STATISTICAL MECHANICS

Date: 04-11-2016 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

Section – A

Answer all the questions. **(10 x 2 = 20 Marks)**

1. What is meant by phase-space? Define phase trajectory.
2. Find the total number of ways three bosons can be arranged in three quantum states.
3. Distinguish between micro canonical ensemble and grand canonical ensemble.
4. Write down the Maxwell Boltzmann and Fermi-Dirac distribution functions
5. Why rotons do not contribute to specific heat at temperature below 1K?
6. The pressure exerted by a system of Boson gas below critical temperature is independent of its volume. Validate this statement.
7. Is nuclear matter degenerate or not? Justify your answer.
8. What happens to the entropy of a Fermi gas at absolute zero?
9. Define the correlation function for a randomly fluctuating quantity.
10. State Nyquist theorem.

Section – B

Answer any four questions. **(4 x 7.5 = 30 Marks)**

11. Obtain Maxwell Boltzmann distribution law.
12. Calculate the entropy of an ideal gas using canonical partition function.
13. How does Landau explain the super-fluidity of liquid Helium?
14. Derive the Richardson-Dushman equation for thermionic emission.
15. Prove that the fractional fluctuation in concentration is smaller for FD statistics and larger for BE statistics than MB statistics.

Section – C

Answer any four questions. **(4 x 12.5 = 50 Marks)**

16. State and prove Liouville's theorem. Use it to arrive at the principle of conservation of density in phase space.
17. a) Obtain Grand canonical distribution function.
    b) Consider an ideal gas in grand canonical ensemble. Show that its fugacity is directly proportional to concentration.
18. Explain the phenomenon of BE condensation. Why only Bosons and no other particles exhibit it? Show how the distribution of Bosons varies with temperature.
19. Calculate the pressure exerted by a FD gas of relativistic electrons in the ground state. Use the result to explain the existence of Chandrasekhar limit on the mass of a white dwarf.
20. Derive the Boltzmann transport equation. Use it to find the distribution function in the absence of collisions.

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