LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2017**

16PPH3MC01/PH 3814 – STATISTICAL MECHANICS

Date: 01/11/2017   Dept. No.   Max. : 100 Marks
Time: 09:00-12:00

PART-A

Answer ALL questions   **(10x2=20 marks)**

1. What is meant by phase space? Define phase space trajectory.
2. Define stationary ensemble.
3. Write down the canonical partition function for an ideal mono atomic gas.
4. State equipartition theorem.
5. Differentiate between density of states $g(\ )$ and degeneracy g_i.
6. Write down the quantum mechanical analog of classical Liouville equation.
7. Why Fermions do not condense?
8. What are phonons?
9. What is the origin of Pauli Para magnetism?
10. Show that nucleons form a degenerate Fermi gas.

PART-B

Answer any FOUR questions   **(4x7$^{1}/_{2}$=30 marks)**

11. Prove that entropy is an extensive property of the thermo dynamical system.
12. Obtain the thermodynamic parameters of classical harmonic oscillators using canonical ensemble.
13. Find the energy fluctuation in grand canonical ensemble.
14. Apply the BE statistics to photons and obtain Planck's formula for the energy density of black body radiation
15. Show that Fermi gas exerts pressure even at absolute zero temperature.
16. Discuss the Langevin classical theory of paramagnetism

PART-C

Answer any FOUR questions **(4x12^1/$_2$=50 marks)**

17. State and Prove Liouville's theorem.

18. Outline Einstein's theory of specific heat capacity.

19. Obtain the expression for the Grand canonical potential. From it prove the ideal gas law.

20. Establish the density operators for all three ensembles in quantum statistics.

21. Show that mass of a white dwarf star cannot be larger than a limiting mass known as Chandrasekar limit.

22. Explain the super-fluidity of liquid helium using Landau's theory.