LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRST SEMESTER – APRIL 2017

PH 1815/PH 1810 - STATISTICAL MECHANICS

Date: 02-05-2017 Dept. No. Max. : 100 Marks
09:00-12:00

SECTION – A

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

1. Why doesn't two phase lines not intersect in phase space?
2. State any two postulates of Statistical Mechanics.
3. Sketch Maxwell's velocity distribution.
4. When is the classical limit of the quantum description of the system valid?
5. Distinguish between Bosons and Fermions.
6. What is mechano-caloric effect exhibited by He-II?
7. If E_1, E_2, E_3 etc are various energy levels of a system of 5 electrons, what would be its Fermi energy?
8. Does a Fermi gas exert pressure at absolute zero? Substantiate your answer.
9. Why does small particles immersed in a fluid show Brownian motion?
10. Define spectral density for a randomly fluctuating quantity.

SECTION – B

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

11. Obtain the condition for mechanical equilibrium between two systems.
12. (a)Prove that entropy is an extensive property of the system. (3)
    (b) Write down the wave function of a two particle system when the particles are: i)Classical ii)Bosons iii)Fermions (4.5)
13. State and prove equipartition theorem.
14. Derive Planck's radiation law. Show that the partition function $z = \frac{2\pi kT}{h\omega}$ for an oscillator defined by $E = \frac{P^2}{2m} + \frac{m\omega^2 q^2}{2}$
15. Derive the Richardson-Dushman equation for thermionic emission.
16. Obtain an expression for the energy fluctuation in a canonical ensemble.

SECTION – C

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

17. State and prove Liouville's theorem. Express the equation of motion of a phase point as a Poisson's bracket.

18. Demonstrate that the state of two different ideal gases is more highly ordered when they are separated than when they are mixed.
19. Discuss the thermodynamic properties of an ideal Bose-Einstein gas
20. Explain the super-fluidity of liquid helium using Landau's theory
21. Treating the white dwarf like an ideal Fermi gas, obtain an expression for Chandrasekhar limit.
22. Derive the Boltzmann transport equation. Use it to find the distribution function in the absence of collisions.

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