LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIRSTSEMESTER – APRIL 2018

PH 1815- STATISTICAL MECHANICS

Date: 02-05-2018 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

PART –A

Answer **ALL** the Questions (10 x 2 = 20)

1. Distinguish between macroscopic and microscopic states of a system.
2. Define phase space.
3. What is grand canonical potential? Express grand canonical partition function in terms of the potential.
4. Write down the Maxwell Boltzmann and Fermi-Dirac distribution functions
5. What is fountain effect?
6. Why phonons cannot be polarized while photons can be polarized? Give reasons.
7. What happens to the entropy of a Fermi gas at absolute zero?
8. What is meant by Fermi momentum?
9. Define mean square deviation.
10. Define the correlation function for a randomly fluctuating quantity.

PART–B

Answer any **FOU**R Questions (4 x 7.5 = 30)

11. State and explain the basic postulates of Statistical Mechanics.
12. Obtain Maxwell Boltzmann distribution law.
13. State and prove equipartition theorem.
14. Derive 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.
16. Prove that phase trajectory of a harmonic oscillator is an ellipse. Hence draw the phase trajectory of a damped harmonic oscillator.

PART – C

Answer any **FOU**R Questions (4 x 12.5 = 50)

17. Calculate the entropy of an ideal Boltzmann gas using microcanonical ensemble. Explain the corrections to be made to obtain the SakurTetrode equation and thus obtain the correct entropy of the system.
18. Calculate the entropy of an ideal gas using canonical ensemble. From this, obtain the equation of states.
19. Discuss the thermodynamic properties of an ideal Bose-Einstein gas.
20. 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.
21. Discuss Brownian motion in one dimension and obtain an expression for the particle concentration as a function of (x, t). Explain how Einstein estimated the particle diffusion constant.
22. What is phase space? State and prove Liouville's theorem.

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