C 82890 (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER M.A./M.Sc./M.Com. DEGREE EXAMINATION JUNE 2020

(CUCSS)

Physics

PHY 2C 07—STATISTICAL MECHANICS

(2012 Admissions)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions.*
Each question has a weightage of 1.

1. Write Boltzmann formula for entropy and explain.
2. What is Gibbs paradox ?
3. State Virial theorem.
4. State Liouvillie's theorem.
5. What is density matrix ?
6. Find expressions for pressure and energy of an ideal Bose gas.
7. Write blackbody distribution law and explain the terms.
8. What is Stefan - Boltzmann law ?
9. Distinguish between para and diamagnetism.
10. Write the expression for specific heat for a metallic solid ?
11. Define Fermi energy.
12. What are photons and phonons ?

(12 × 1 = 12 weightage)

Section B

Answer any **two** *questions.*
Each question carries a weightage of 6.

13. Obtain the partition function for a collection of classical, one dimensional harmonic oscillators using canonical ensemble. Hence find pressure, internal energy and chemical potential.
14. Show that for large N, micro-canonical, canonical and grand canonical ensembles are equivalent.

Turn over

15. Obtain an expression for the specific heat of a non-metallic solid at high and low temperatures.
16. Using Landau's theory of diamagnetism obtain an expression for susceptibility.

(2 × 6 = 12 weightage)

Section C

Answer any **four** *questions.*
Each question carries a weightage of 3.

17. Obtain the phase space trajectory of a freely falling particle.
18. 2 particles and 3 energy levels are given. Compute the number of possible states if the particles are bosons and fermions.
19. Starting from grand canonical ensemble, using occupation number concept, obtain expressions for partition function for bosons and fermions.
20. Find an expression for critical temperature of a Bose gas below which Bose Einstein condensation will occur.
21. Show that entropy of photon gas is proportional to T^3.
22. If number density of electrons in a white dwarf is $10^{36}/m^3$, what is the approximate Fermi temperature ?

(4 × 3 = 12 weightage)