

IMPORTANT INSTRUCTIONS FOR PAPER ID 53403

1. Attempt any 4 part out of the given 8 from question No. 1.
2. UNIT NO. 4 (Question No. 8 & 9) be treated as deleted or null & void.
3. Attempt any 04 questions from question No. 2 to 7.

7. What is Maxwell Boltzmann Statistics ? Derive an expression for Maxwell Boltzmann law of distribution of molecular speeds. 16

Unit IV

8. (a) What is Fermi Dirac Statistics ? What are its assumptions ? 6
(b) What is Electron Gas ? Derive an expression for energy distribution of free electrons in metal. 6
(c) What are the properties of liquids helium ? 4
9. (a) What is Fermi Energy ? Derive an expression for it. 7
(b) What are the differences between Maxwell Boltzman and Fermi Dirac Statistics ? 5
(c) What do you mean by specific heat of metals ? Explain. 4

Roll No.

Exam Code : J-21

Subject Code—53403

B. Sc. EXAMINATION

(Batch 2018 Onwards)

(Main & Re-appear)

(Fourth Semester)

PHYSICS

CPL-402

Statistical Mechanics (Core Course–VII)

Time : 3 Hours

Maximum Marks : 80

Note : Attempt *Five* questions in all. Q. No. 1 is compulsory. All questions carry equal marks.

(Compulsory Question)

1. (a) What do you mean by Grand Canonical Ensemble ? 2
(b) What do you mean by the principle of equal a priori probability ? 2

- (c) Define (i) Conduction, (ii) Diffusion. 2
- (d) State and explain law of equipartition of energy. 2
- (e) What do you mean by negative temperature ? Explain. 2
- (f) What do you mean by Momentum Space ? 2
- (g) What are fermions and bosons ? Give examples. 2
- (h) What are the differences between BE and FD statistics ? 2

Unit I

- 2. (a) Explain the following : 6
 - (i) Microstate
 - (ii) Macrostate
 - (iii) Thermodynamical probability
 - (iv) Constraints on a system.
- (b) Define thermodynamical probability for distributing n distinguishable particles in two compartments. Find the probability of macrostate. 10

- 3. Define Partition Function. Derive its relation with various thermodynamics quantities. 16

Unit II

- 4. (a) Derive Maxwell's speed distribution law. Find the expressions for most probable speed, average speed and root mean squares speed. 12
- (b) Calculate root mean square speed and most probable speed of Hydrogen at 28°C. Given $k = 1.38 \times 10^{-23} \text{ JK}^{-1}$ and mass of hydrogen molecule = $3.34 \times 10^{-27} \text{ Kg}$. 4
- 5. (a) Explain mean free path and show that it is inversely proportional to pressure of the gas. 8
- (b) What are transport phenomena in gases ? Explain diffusion on the phenomenon of molecular collision. 8

Unit III

- 6. (a) Explain the term phase space and its division into cells. 8
- (b) What are the basic assumptions of three statistics ? 8