

Roll No. ....

Exam Code : NI-24

Subject Code—61407

**B. Sc. EXAMINATION**

(Batch 2019 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, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) Define and differentiate between static and dynamic system. 2
- (b) Explain the equilibrium state of dynamic system. 2

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Independent quantity, variable, coordinates, are describe the motion of particles is called degree of freedom.

- (c) State the law of equipartition of energy. 2
- (d) Define Degrees of Freedom. Find the degrees of freedom for diatomic gas molecule. 2
- (e) What is Gibbs Paradox ? 2
- (f) Describe the basic approach of 3 statistics. 2
- (g) What is Photon Gas ? Differentiate between Photons and Bosons. 2
- (h) Find the Thermodynamic Probability of 4 fermions distributed in 6 cells. 2

### Unit I

- 2. (a) Define Ensembles. Explain and differentiate between three types of Ensembles. 8
- (b) Write the number of Microstates and Macuostates of a system of 3 distinguish particles distributed in 2 equal sized boxes. 8



3. (a) Define Thermodynamical Probability of a system. Derive the expression for  $W$  for  $n$  distinguishable particles in  $K$  unequal sized boxes. 10

(b) Define Partition Function. Derive the expression of Entropy in terms of  $Z$ . 6

### Unit II

4. (a) Derive the expression for Maxwell Speed Distribution Law. 12

(b) Calculate the mean free path of  $O_2$  molecule at NTP. (Molecular Diameter for  $O_2$  is  $2\text{\AA}$ ). 4

5. Explain the viscosity transport phenomena in gases. Derive the expression for  $\eta$ . 16

### Unit III

6. (a) Differentiate between the three type of Statistics. 8

(b) Derive the relation between entropy and thermodynamic probability. 8



7. (a) Distribute 4 particles in 2 cells under :
- (i) MB Statistics
  - (ii) BE Statistics
  - (iii) FD Statistics. 12
- (b) Determine the number of phase space cells for a free particles. 4

#### Unit IV

8. (a) What are black body radiations ? Derive the Planck's Law in terms of frequency using Bose-Einstein Distribution. 12
- (b) Explain degeneracy and Bose-Einstein Condensation. 4
9. Derive the expression for Fermi-Dirac Distribution Law. 16