

PC- 369 CV-19  
(523) M.Sc. Physics (Third Semester)  
Term End Examination Dec. 2019-20  
Compulsory/Optional  
Group-  
Paper – II

Name/ Title of Paper: Statistical Mechanics  
Time : Three Hours]

[Maximum Marks : 80  
Minimum Marks : 29

**Note :** Answer from Both the section as Directed. The figures in the right hand margin indicate marks.

Section-A

- 1- Answer the following questions: 1X10
- (a) A Single particle moving in three dimensions constitutes a ----- degree of freedom system.
  - (b) If you have two identical gases at the same temperature and pressure in the two compartments, nothing changes when the partition is removed. (True or False)
  - (c) A Partition function describes the statistical properties of a system in -----equilibrium.
  - (d) Statistical ensemble of several quantum states in called ----- matrix.
  - (e) Particles following Fermi-Dirac Statistics obey the Pauli's exclusion principle. (True or False)
  - (f) The virial equation of State measures of the deviation of a real gas from-----gas.
  - (g) Give the definition of thermal fluctuations.
  - (h) In ----- Statistics particles are identical but distinguishable.
  - (i) Give the definition of enthalpy.
  - (j) Give the Statement of flections dissipation theorem.
- 2- Answer the following questions. 2X5
- (a) Explain the Classical ideal gas.
  - (b) What do you mean by micro canonical ensemble?
  - (c) Define the density matrix.
  - (d) What is classical gas.
  - (e) Explain the two concepts of irreversible processes.

**Section-B**

Answer all question:

**Unit-I**

- 3- Show that in a grand canonical ensemble, if a system is to be an equilibrium state, the temperature, the pressure and the chemical potential must be constant through out the system. 15

**Or**

Explain why does entropy increase on mixing of two gases?

**Unit-II**

- 4- Deduce an expression for Fermi energy of electron gas in a metal at absolute zero temperature. 15

**Or**

What is meant by Bose-Einstein condensation? Explain the properties of Base-Einstein condensation?

**Unit-III**

- 5- Explain and discuss the cluster expansion for a classical gas. Draw the diagram of the cluster expansion for  $N=3$ . 15

**Or**

Explain Ising model. Give the exact solution of Ising model in one dimension.

**Unit-IV**

- 6- Explain thermodynamic fluctuations. Discuss how does energy, pressure and enthalpy under go in thermal fluctuations? 15

**Or**