647510 **BSCsmsCC6020** **Seat No :_____**

B.Sc. Semester - 6 (*CBCS*) Examination

Oct/Nov -2020

STATISTICAL MECHANICS AND SOLID STATE PHYSICS (CORE)

Time: 2:00 Hours **Marks: 56**

Instructions:

1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any four of the following questions.

1(a) Answer the following question (any one). **(7)**

(1) Explain in detail classical Maxwell-Boltzmann distribution law.

(2) Derive the distribution law of Fermi-Dirac statistics.

1(b) Answer the following question (any one). **(4)**

(1) Write a note on microstates and macrostates..

(2) Explain Stirling's approximation.

1(c) Answer the following question (any three). **(3)**

(1) The minimum volume of cell in a phase space is ……..

(2) …….. statistics is used for elementry particles such as electron,proton, positron.

(3) Molecules of gas obey …… distribution law.

(4) …….statistics is classical statistics.

(5) The particles which obey Fermi-Dirac statistics are known as …….

2(a) Answer the *following* question (any one). **(7)**

(1) Explain in detail crystal lattice and lattice translation vector.

(2) Write a note on ionic crystal.

2(b) Answer the following question (any one). **(4)**

(1) Write a short note on dimond cubic structure.

(2) Explain density of modes in one dimensional lattice.

2(c) Answer the following question (any three). **(3)**

(1) Lattice +…… = Crystal structure.

(2) Number of atoms in the unit cell of simple cubic structure is …….

(3) Nacl is …….. type of crystal.

(4) A simple thermodynamic relation connecting C_p and C_v is C_p-C_v= …….

(5) The possible energy levels of a harmonic oscillator are given by E_n = ……..

3(a) Answer the following question (any one). **(7)**

(1) Explain free electron gas in one dimensional box.

(2) Write a note on Hall effect.Also define Hall voltage and Hall coefficient.

3(b) Answer the following question (any one). **(4)**

(1) Explain density of states in one dimension.

(2) Explain Wiedemann-Franz law.

3(c) Answer the following question (any three). **(3)**

(1) Hamiltoniam H= …… energy+ …….energy

(2) The relation between wave vector k and wavelengh λ is given by equation k= ……..

(3) Write the equation of Fermi wave vector for free electron gas in 3 dimensions.

(4) The heat capacity of free electrons should be ……

(5) At low temperatures the value of Lorentz number tends to ……..

4(a) Answer the following question (any one). **(7)**

(1) Explain insulators.

(2) Describe band structure of siliocon and germanium.

4(b) Answer the following question (any one). **(4)**

(1) Explain effect of impurities in semiconductors.

(2) Explain doner states in semiconductors.

4(c) Answer the following question (any three). **(3)**

(1) Low electrical conductivity of insulator is due to ……..

(2) Fermi energy is that energy which makes Fermi-Dirac function f(E)= ……..

(3) In P-type semiconductors …….. are minority charge carriers.

(4) Unit of energy gap is ……...

(5) The semiconductor obtained by doping impurities in pure semiconductor is called…… semiconductor.

5(a) Answer the following question (any one). **(7)**

(1) Explain London's theory in detail.

(2) Explain BCS theory.

5(b) Answer the following question (any one). **(4)**

(1) Write a short note on Meissner effect.

(2) Explain the application of superconductivity.

5(c) Answer the following question (any three). **(3)**

(1) The first superconductor material discovered by Onnes is……..

(2) At T_c resistance of superconductor becomes ……

(3) The relation between T_c and isotopic mass M in superconductor is $M^{1/2}T_c$ =……

(4) There are ……. types of superconductors.

(5) A current flows through the insulator eventhough no potential difference is applied across the junction is called ……. Josephson effect.