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

B.Sc. Semester - 6 (*CBCS*) Examination
April/May-2022 (OLD COURSE)
STATISTICAL MECHANICS AND SOLID STATE PHYSICS(CORE)

Time: 2:30 Hours **Marks: 70**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

Q.1 (a) Answer the following questions (any one) **07**

1. Explain: Classical Maxwell-Boltzmann distribution law.
2. Derive the distribution law of Bose-Einstein.

Q.1 (b) Answer the following questions (any one) **04**

1. Explain thermodynamic probability.
2. Explain Stirling's approximation.

Q.1 (c) Answer the following questions (any three) **03**

1. Which statistics is used for photons?
2. The minimum volume of cell in a phase space is ……..
3. The particles which obey Fermi-Dirac statistics are known as ……
4. …….statistics is classical statistics.
5. Molecules of gas obey …… distribution law.

Q.2 (a) Answer the following questions (any one) **07**

1. Write a note on ionic crystal.
2. Write a note on heat capacity of solids.

Q.2 (b) Answer the following questions (any one) **04**

1. Write a short note on diamond cubic structure.
2. Write a short note on metallic crystal.

Q.2 (c) Answer the following questions (any three) **03**

1. The Debye model is valid for ……. wavelengths.
2. Lattice +…… = Crystal structure.
3. Number of atoms in the unit cell of simple cubic structure is …….
4. NaCl is …….. Type of crystal.
5. The substance which has regular internal structure is called …….

Q.3 (a) Answer the following questions (any one) **07**

1. Write a note on Hall Effect. Define Hall Coefficient.
2. Explain free electron gas in three dimensions.

Q.3 (b) Answer the following questions (any one) **04**

1. Derive the Boltzmann Equation.
2. Explain Wiemann-Franz law.

Q.3 (c) Answer the following questions (any three) **03**

1. Write the equation of Fermi wave vector for free electron gas in 3 dimensions.
2. At low temperatures the value of Lorentz number tends to ……..
3. Hamiltonian H = …… energy + ……. energy
4. The energy of top-most filled level at 0 K is known as ……. energy.
5. The relation between wave vector k and wavelength λ is given by equation k = ……..

Q.4 (a) Answer the following questions (any one) **07**

1. Describe the band structure of Silicon and Germanium.
2. Explain insulators.

Q.4 (b) Answer the following questions (any one) **04**

1. Explain: electrical conductivity of intrinsic semiconductors.
2. Explain the effect of impurities in semiconductors.

Q.4 (c) Answer the following questions (any three) **03**

1. In P-type semiconductors …….. are minority charge carriers.
2. The equation of Fermi-Dirac function is f (E) = …….
3. The unit of Energy band gap (E_g) is …….
4. Abesence of electron in semiconductor is called …….
5. Energy gap is also known as ……..gap.

Q.5 (a) Answer the following questions (any one) **07**

1. Explain London's theory in detail.
2. Explain: BCS theory.

Q.5 (b) Answer the following questions (any one) **04**

1. Write a short note on Meissner effect.
2. Write the applications of superconductivity.

Q.5 (c) Answer the following questions (any three) **03**

1. The transition temperature T_c of mercury is ……K.
2. λ_L is measure of …….. depth of the magnetic field in superconductor material.
3. There are ……. types of superconductors.
4. The first superconductor material discovered by Onnes is……..
5. A Superconductor Exhibits a perfect ……. Magnetism.

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