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

B.Sc. Semester - 6 (*CBCS*) Examination
March/April-2024 (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.

Que.1(A) Answer the following questions. (any one) (07)

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

(2) Explain: Classical Maxwell-Boltzmann distribution law.

Que.1(B) Answer the following questions. (any one) (04)

(1) Explain Stirling's approximation.

(2) Explain in brief microstates and macrostates.

Que.1(C) Answer the following questions. (any three) (03)

(1) ……. statistics is used in the case of distinguishable particles.

(2) Which statistics is used for photons?

(3) …….statistics is classical statistics.

(4) ……. formula gives the approximate values of ln n!

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

Que.2(A) Answer the following questions. (any one) (07)

(1) Write a note on ionic crystal.

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

Que.2(B) Answer the following questions. (any one) (04)

(1) Explain Debye model.

(2) Write a short note on diamond cubic structure.

Que.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 that has a regular internal structure is called …….

Que.3(A) Answer the following questions. (any one) (07)

(1) Write a note on Hall Effect. Also, define Hall coefficient.

(2) Explain free electron gas in one dimension.

Que.3(B) Answer the following questions. (any one) (04)

(1) Explain Wiemann-Franz law.

(2) Explain the density of states in one dimension.

Que.3(C) Answer the following questions. (any three) (03)

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

(2) Hamiltonian H = …… energy + ……. energy

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

(4) The energy of the 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 =…..

Que.4(A) Answer the following questions. (any one) (07)

(1) Explain electron-hole carrier concentration.

(2) Explain insulators.

Que.4(B) Answer the following questions. (any one) (04)

(1) Explain donor states in semiconductors.

(2) Explain: the electrical conductivity of intrinsic semiconductors.

Que.4(C) Answer the following questions. (any three) (03)

(1) In N-type semiconductors …….. are majority charge carriers.

(2) The equation of the Fermi-Dirac function is f (E) = …….

(3) The unit of Energy band gap (E_g) is …….

(4) The semiconductor without any doping is called ……semiconductor.

(5) Forbidden gap is also known as ……..gap.

Que.5(A) Answer the following questions. (any one) (07)

(1) Explain London's theory in detail.

(2) Explain: BCS theory.

Que.5(B) Answer the following questions. (any one) (04)

(1) Write the applications of superconductivity.

(2) Explain the influence of external agents on superconductivity.

Que.5(C) Answer the following questions. (any three) (03)

(1) A Superconductor exhibits a perfect diamagnetism. [True/False]

(2) The relation between critical magnetic field H_c and transition temperature T_c is H_c =……

(3) There are two types of superconductors. [True/False]

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

(5) At T_c resistance of the superconductor becomes …….

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