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FIFTH SEMESTER (CUFYUGP) DEGREE EXAMINATION, NOVEMBER 2026

PHYSICS / APPLIED PHYSICS

PHY5EJ301(1)/APH5EJ303(2) : PROPERTIES OF SOLIDS

2024 Admission onwards

Maximum Time :2 Hours **Maximum Marks :70**

Section A

All Questions can be answered. Each Question carries 3 marks (Ceiling : 24 Marks)

1	Differentiate primitive cell non primitive cell and conventional cell from one another. How is Weigner Seitz cell constructed.
2	Diamond is the hardest substance known inspite of the fact that the packing fraction and the coordination number of carbon atom in the dc structure are quiet law. Explain.
3	Distinguish between reciprocal lattice and direct lattice. How can you observe reciprocal lattice of a crystal experimentally.
4	What are the failures of the Drude-Lorentz free electron theory.
5	How does the band theory lead to the concept of negative effective mass?
6	Explain the concepts of drift current and diffusion current. How are they different?
7	What is the essential difference between the classical theory and the quantum theory of paramagnetism.
8	Explain the following in brief: Ionic polarization, electronic polarization, orientational polarization.
9	The conductivity of metals decreases while that of semiconductors increases with rise in temperature , Explain.
10	Distinguish between reciprocal lattice and direct lattice. How can you observe reciprocal lattice of a crystal experimentally.

Section B

All Questions can be answered. Each Question carries 6 marks (Ceiling : 36 Marks)

11	Draw (101) and (111) planes in a cubic unit cell. Determine the Miller Indices of the directions which are common to both the plains.
12	An X ray beam of wavelength 0.71 Å is diffracted by a cubic KCl crystal of density 1.99×10^{3} Kgm^{-3}. Calculate the interplanar spacing for (200) planes and the glancing angle for the second order reflection from these Planes the molecular weight of KCl is 74.6 amu and the Avogadro's number is 6.023×10^{26} $Kg^{-1}mole^{-1}$
13	Derive the three dimensional wave function for the free electron gas and obtain its eigen values.

14	The energy near the valence bandage of a crystal is given E=-Ak^2 where A=10^{-39} Jm^2 . An electron with the wave vector K =10^{10} k_x m^{-1} is removed from an orbital in the completely filled valance band determine the effective mass velocity Momentum and energy of the hole.
15	Derive expressions for the electron and whole concentrations for an intrinsic semiconductor. Use these results to obtain intrinsic carrier concentration.
16	Derive an expression for diamagnetic susceptibility using the Quantum theory.
17	The optical index of refraction and the dielectric constant for water are 1.33 and 8.1 respectively determine the percentage of ionic Polarisability.
18	What are Brillouin zones. Determine the reciprocal lattice vectors which define the Brillouin zones of bcc and fcc lattices.
Section C	
Answer any ONE .Each Question carries 10 marks (1x10=10 Marks)	
19	Derive expression for density of free electrons and holds in an intrinsic semiconductor show that the Fermi level lies half way between the valence band and the conduction band.
20	Distinguish between the characteristic features of diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism and ferrimanentism. Give an example of each type of material. Comment on the temperature variation of susceptibility for all types of materials.