16-11-22

Paper / Subject Code: PHD107 / Physics - Solid State Physics

PHD 107

Total No. of Printed Pages:2

B.Sc. (Semester-V)
EXAMINATION NOVEMBER 2022
Physics
Solid state Physics

[Duration : Two Hours] **[Total Marks : 60]**

Instructions:
i. All questions are compulsory
ii. Figure to the right indicate mark
iii. Symbols have their usual meaning unless otherwise stated.
iv. Draw neat diagrams wherever necessary
v. Use of non-programmable calculator is permitted

Q.1 Answer any **Five** of the following. **2x5=10**

a) Define unit cell and primitive cell
b) What is thermionic emission?
c) State Bloch theorem and write Bloch function.
d) What is magnetic susceptibility?
e) What is magnetic permeability and relative permeability?
f) Define the terms ferroelectrics and ferroelectric effect
g) What is Piezoelectric effect?

Q.2 Answer any **Five** of the following. **2x5=10**

a) Define space lattice.
b) What are reciprocal lattices?
c) What is significance of E-k diagram.
d) A horizontal component of flux density of Earth's magnetic field is 1.7×10^{-7} weber/m^2 . What is the horizontal component of the magnetic intensity.
e) What is depolarising field?
f) What are Plasma oscillations?
g) Explain Pyroelectric effect.

Q.3	A)	i) What are Miller indices?	2
		ii) Draw the following planes inside unit cell of a cubic crystal. (111), (231) and (110)	3
		OR	
	A)	What are X-rays? What is Bragg's law? Derive Bragg's law for diffraction of X-rays	5
	B)	Define the terms atomic radius and Packing factor. Calculate the same for FCC structure.	5
Q.4	A)	i) Discuss drawbacks of free electron theory of metals.	2
		ii) Find the temperature at which there is 1% probability that a state with an energy 0.5eV above Fermi Energy will be occupied.	3
		OR	
	A)	Using classical free electron model derive expression for conductivity of metal.	5
	B)	Explain the concept of hole in considering total current flowing through a semiconductor	5
Q.5	A)	i. Define the term magnetic susceptibility?	2
		ii. Estimate the susceptibility of solid argon. Argon has atomic number 18 and at 4K its concentration is 2.66×10^{23} atoms/m^3. Take root mean square distance of an electron from the nearest nucleus to be 0.62 Å. Also calculate the magnetization of solid argon in a 2.0T induction filed.	3
		OR	
	A)	Write short notes on Paramagnetism, Diamagnetism and Ferromagnetism	5
	B)	Derive expression for diamagnetic susceptibility on the basis of classical Langevin Theory.	5
Q.6	A)	i) Define electric susceptibility?	2
		ii) What is ferroelectric domain?	3
		OR	
	A)	Explain PE curve of ferroelectric material.	5
	B)	Obtain Clausius Mosotti relation between polarizability and dielectric constant of a solid.	5