

B.Sc. T.Y. (CBCS Pattern) Semester-V
USDSEPHT10 - Physics Paper-II - Solid State Physics

P. Pages : 2

Time : Three Hours



GUG/W/24/13094

Max. Marks : 50

- Notes : 1. All questions are compulsory.
2. Draw neat and well labelled diagrams wherever necessary.

Either

1. A) i) State and derive Bragg's law of x-ray diffraction in crystal. How Bragg's law helps to determine crystal structure of materials? **5**
- ii) Distinguish between crystalline solids and Amorphous solids. **3**
- iii) The interplanar spacings for a given [hkl] planes is 2.82 Å. It is found that the first order reflection occurs at an angle of 10 degree. What is the wavelength of x-rays? **2**

OR

- B) a) What are Miller Indices? How are they obtained? **2½**
- b) Draw the planes [100], [010] and [111] in a simple cubic unit cell. **2½**
- c) Draw Bravais lattices in two dimensions. **2½**
- d) Explain concept of Reciprocal lattice? **2½**

Either

2. A) i) What is diamagnetic substance? **1**
- ii) Define magnetic susceptibility and state its value for di, para and ferro magnetism. **2**
- iii) Discuss Langevin's theory of diamagnetism and obtain expression for diamagnetic susceptibility. **7**

OR

- B) a) Distinguish between diamagnetic, paramagnetic and ferromagnetic substances. **2½**
- b) Give the Weiss theory of ferromagnetism. **2½**
- c) Prove that susceptibility of paramagnetic substance is inversely proportional to temperature. **2½**
- d) The maximum value of the permeability of the material is 0.126 N/A^2 . What is the relative permeability and magnetic susceptibility of the medium (permeability of the free space = $4\pi \times 10^{-7} \text{ henry/m}$). **2½**

Either

3. A) i) Obtain Clausius - Mossotti Equation for dielectrics. **6**
- ii) Derive the relation between \vec{D} , \vec{E} and \vec{P} . **2**

- iii) A magnetic material has a magnetization of 2300 A/m and produces a flux density of 0.00314 Wb/m². 2

Calculate magnetizing force and relative permeability of the material.

OR

- B) a) Write short notes on polar and non-polar dielectrics. 2½
- b) Derive Langevin-Debye equation. 2½
- c) Explain the concept of electric polarizability on the basis of classical theory. 2½
- d) The dielectric constant of a medium is 5. The dielectric displacement vector in it is $5 \times 10^{-12} \text{ C/m}^2$. Calculate the electric field intensity? ($\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$). 2½

Either

4. A) i) Discuss Kronig-Penney model. 6
- ii) Explain Hall effect in semi-conductor. 2
- iii) Assuming that there are 5×10^{28} atoms/m³ in copper, find the Hall Coefficient. 2
- Given $e = 1.602 \times 10^{-19} \text{ C}$.

OR

- B) a) Discuss conductor, semi conductors and insulators on the basis of energy band diagram. 2½
- b) Explain the term superconductivity. What are the Type-I and Type-II super conductor? 2½
- c) Explain effect of external electric field on superconductors. 2½
- d) Find the critical field in pb at $T = 4.2 \text{ K}$. Here $H_c(0) = 0.0803 \text{ Wb/m}^2$ for pb. 2½

5. Solve **any ten** of the followings.

- a) What are Primitive and Non-Primitive unit cell? 1
- b) Define lattice and basis. 1
- c) Give at least two applications of Bragg's law. 1
- d) State Curie law of Para magnetism. 1
- e) What is anti ferromagnetic substance? 1
- f) Define curie temperature. 1
- g) Give applications of dielectric substances. 1
- h) What is polarization vector? 1
- i) What is Fermi energy? 1
- j) Explain the concept of hole. 1
- k) Define Fermi energy. 1
- l) Give at least two application of superconductivity. 1
