

B. Tech.
(Semester-II) Theory Examination 2017 - 18
ENGINEERING PHYSICS-II
Time: 3 Hours
Total Marks: 70
Note: Attempt all Sections. If require any missing data then choose suitably.

SECTION A
1. Attempt all questions in brief.
2 x 7 = 14

- a. Define unit cell and primitive cell.
- b. Find out the packing factor for a Simple Cubic structure.
- c. What is ionic polarization in dielectrics?
- d. What is the origin of magnetization in magnetic materials?
- e. What is the difference between conduction current and displacement current?
- f. What do you mean by intrinsic and extrinsic semiconductors?
- g. Explain effect of temperature on electrical resistivity of superconducting materials.

SECTION B
2. Attempt any three parts of the following:
7 x 3 = 21

- a. Derive an expression for Compton shift. Explain the presence of unmodified radiation in Compton scattering.
- b. Explain ferroelectricity and piezoelectricity. Give some applications of ferroelectric and piezoelectric materials.
- c. Derive the electromagnetic wave equations in free space. Prove that the electromagnetic waves propagate with speed of light in free space.
- d. Show that the Fermi level of an intrinsic semiconductor lies half way between conduction band and valance band. What will be position of Fermi level in n-type semiconductor? Explain with suitable diagram.
- e. What are carbon nanotubes? Discuss arm chair, zigzag and chiral single walled carbon nanotubes

SECTION C
3. Attempt any one part of the following:
7 x 1 = 7

- (a) Show that in a cubic lattice the distance between successive planes of indices (h k l) is given by $d_{hkl} = \frac{a}{\sqrt{h^2+k^2+l^2}}$, where 'a' is lattice constant. A substance with FCC lattice has density 6250-kg/m^3 and molecular weight 60.2. Calculate the lattice constant. Given, Avogadro's number is 6.02×10^{23} per gm molecule.
- (b) What is Laue's spot in X-ray diffraction? Explain how Bragg's law explained formation of Laue's spot? Calculate the longest wavelength that can be analyzed by a crystal of spacing 2.82 \AA in the second order.

4. **Attempt any one part of the following:** **7 x 1 = 7**
- (a) Explain dielectric loss. Deduce an expression for dielectric loss and sketch the loss spectrum for a polar material.
- (b) Distinguish diamagnetic, paramagnetic and ferromagnetic substances. A material has 10 turns per cm of wire wound uniformly upon it which carries a current of 2.0 ampere. The flux density in the material is 1.0 Weber/m². Calculate the magnetization of material ($\mu_0 = 4\pi \times 10^{-7}$ weber/amp-meter).
5. **Attempt any one part of the following:** **7 x 1 = 7**
- (a) Derive Maxwell's equations in differential form. Give physical significance of each equation.
- (b) Prove that electromagnetic waves are transverse in nature. If the magnitude of E in a plane electromagnetic wave is 377 V/m, determine the magnitude of H in free space.
6. **Attempt any one part of the following:** **7 x 1 = 7**
- (a) Find out the probability of occupancy of an energy level by an electron if (i) $E < E_F$ and (ii) $E > E_F$, where E_F is Fermi energy. Calculate the probability of occupancy of energy level by an electron at 300K which is lying 0.015eV below Fermi-level.
- (b) Deduce an expression for the concentration of electrons in conduction band of an intrinsic semiconductor. A semiconductor rod of 10 mm length and 1 mm² cross-section has been doped with a total of 5×10^{13} donor atoms at room temperature. Calculate the electron and hole densities if the intrinsic carrier density in semiconductor is $2.4 \times 10^{19} \text{ m}^{-3}$.
7. **Attempt any one part of the following:** **7 x 1 = 7**
- (a) Discuss Meissner effect. Show that perfect diamagnetism and zero resistivity are two independent and essential properties of the superconductor.
- (b) Explain superconductivity on the basis of BCS theory. Determine critical current and current density, which can flow through a long thin superconducting wire of diameter 2 mm if critical field for the material is 1.2×10^4 A/m.