Printed Pages: 02   **Sub Code: RAS201**

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B TECH
(SEM II) THEORY EXAMINATION 2018-19
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. Explain the terms space lattice and unit cell as applied to a crystal structure.
   b. What is packing factor? Write general expression for it.
   c. What are polar and non- polar dielectrics?
   d. What is hysteresis curve?
   e. What is displacement current?
   f. Classify solids in different groups on the basis of band theory.
   g. Define cooper pairs in superconductors.

SECTION B

2. **Attempt any *three* of the following:**   **7 x 3 = 21**

   a. What is Compton effect? Derive an expression for Compton shift.
   b. Derive Clausius- Mossotti equation. Find the percentage of ionic polarizability in NaCl which has refractive index and dielectric constant 1.5 and 5.6 respectively.
   c. What is skin depth? Find the skin depth at a frequency of 3.0×10^6 Hz in aluminium. Where $\sigma = 38 \times 10^6$ S/m and $\mu_r = 1$. (Given $\mu_0 = 4\pi \times 10^{-7}$ N/A^2)
   d. Define conductivity of a semiconductor. Find the expression for conductivity of intrinsic semiconductor, n-type semiconductor and p- type semiconductor.
   e. Explain critical magnetic field with suitable diagram. For a specimen of superconductor, the critical fields are 1.4×10^5 and 4.2×10^5 A/m for temperature 14 K and 13 K respectively. Calculate the transition temperature and critical fields at 0 K and 4.2 K.

SECTION C

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

   (a) Derive the relation for inter-planar spacing between the parallel planes. Find out the ratio $d_{100}:d_{110}:d_{111}$ for simple cubic systems.
   (b) Derive Bragg's law for the diffraction of X- rays by crystals. Describe Bragg's spectrometer explain how it is used to study the structure of crystal.

4. **Attempt any *one* part of the following:**   **7 x 1 = 7**

   (a) What is dielectric polarization? Explain the different types of polarization mechanism in dielectrics.
   (b) What is Langevin's theory of diamagnetism? Show that it is independent of temperature.

Page **1** of **2**

5. **Attempt any *one* part of the following:**   **7 x 1 = 7**

   (a)   Write down Maxwell's equations in free space using them prove that velocity of plane electromagnetic waves in free space is equal to the velocity of light and also show that electromagnetic waves are transverse in nature.

   (b)   State and explain Poynting theorem for the flow of energy in electromagnetic waves.

6. **Attempt any *one* part of the following:**   **7 x 1 = 7**

   (a)   What is Fermi level? Show that the Fermi level of an intrinsic semiconductor lies half way between conduction and valence band.

   (b)   Define Fermi Dirac distribution function. Calculate the probability of occupancy energy level by an electron at 300 K which is lying 0.015 eV below Fermi level.

7. **Attempt any *one* part of the following:**   **7 x 1 = 7**

   (a)   Distinguish between type-I and type-II superconductors. Give the salient features of BCS theory of superconductivity.

   (b)   What are carbon nanotubes? Discuss its properties and applications.

Physical constants:

Boltzmann's constant: 1.38×10^{-23} J/K
Permittivity in free space: $\varepsilon_0 = 8.85 \times 10^{-12} C^2 N^{-1} m^{-2}$
Permeability in free space: $\mu_0 = 4\pi \times 10^{-7} NA^{-2}$.