B. Tech.

(SEM II) ODD SEMESTER

MAJOR EXAMINATION 2017-18

Engineering Physics II

Time: 3 Hrs. **Max. Marks: 50**

Note: Attempt all questions. Each question carries equal marks.

Q.1 Attempt any five parts of the following. **(5 x 2 =10)**

(a) Define the following terms in crystal structure

(i) Space lattice, (ii) Basis (iii) Primitive cell (iv) Unit cell

(b) Obtain the Miller indices of a plane which intercepts at a, b/2, 3c in a simple cubic unit cell. Draw a neat diagram showing the plane.

(c) Explain packing factor in cubic lattices? Describe the ways in which crystal may have closest packing of atoms.

(d) Discuss Laue's principle of X-ray diffraction and obtain the diffraction condition for a simple cubic lattice.

(e) Find the reverberation time of an office which has volume of 3000 m^3 and a total sound absorption of 75 metric sabine. Estimate the additional sound absorption required for an optimum reverberation.

(f) What steps would you take to improve the acoustics of hall? Explain with reason.

(g) What is Non-Destructive Testing (NDT)? What are the factors affecting the choice of NDT method.

2 Attempt any two parts of the following: **(2 x 5 =10)**

State Ampere's circuital law and discuss why and how it was modified to include the displacement current. Comment on the statement "The addition of displacement current resulted into unification of electrical and magnetic phenomena."

(b) Write down Maxwell's equation in integral form and convert them into differential form. Give physical significance of each equation.

(c) Deduce the equation of the propagation for the plane electromagnetic wave in free space. Show that the electric and magnetic vectors are normal to each other as well as to the direction of propagation of the wave.

Q.3 Attempt any two parts of the following: (2 x 5 =10)

(a) Derive electromagnetic wave equation in dielectric medium and discuss its solution.

(b) Write down Maxwell's equation in a conducting medium and show that the electric and magnetic field strength will decrease exponentially with the distance from the surface into the conducting medium.

(c) Show that for frequency $\leq 10^9$ Hz, a sample of silicon will act like a good conductor. For silicon, one may assume $\frac{\varepsilon}{\varepsilon_o} = 12$ and $\sigma = 2$ mhos/cm. Also calculate the penetration depth for this sample at frequency 10^6 Hz.

Q.4 Attempt any two parts of the following: (2 x 5 =10)

(a) How are the conductors, semiconductors, and insulators distinguished based on energy band theory? Show how the theory explains the temperature dependence of electrical conductivity of a semiconductor?

(b) Find the expression for drift and diffusion current densities in semiconductors. Show that in n-type semiconductors Fermi level lies in the middle of donor level and bottom of the conduction band.

(c) What are Type I and Type II Superconductors? Describe, in brief, BCS theory of superconductivity.

Q.5 Attempt any two parts of the following: (2 x 5 =10)

(a) What do you mean by superconductivity? Describe the effect of the following on the superconducting properties (i) Magnetic field (ii) Temperature (iii) Isotopes

(b) Explain the reason for the drastic change in the properties of materials at nanoscale. Discuss the structure and properties of carbon nano tubes.

(c) Calculate the drift velocities of holes and electrons in (i) silicon and (ii) germanium at 300K when applied electric field is 60volt/cm. Take $\mu_p = 500$ cm^2/Vs and $\mu_n = 1500$ cm^2/Vs for silicon and $\mu_h = 3700$ cm^2/Vs and $\mu_n = 3600$ cm^2/Vs for germanium.