Hall Ticket No | | | | | | | | | | | Question Paper Code: AHS006

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech I Semester End Examinations (Supplementary) - February, 2017

Regulation: IARE–R16

ENGINEERING PHYSICS

(Common to CSE|IT|ECE|EEE)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Explain the phenomenon of electronic, ionic and orientation based on their polarization mechanism with neat diagrams. **[7M]**

   (b) An elemental solid dielectric material has polarizability $7 \times 10^{-40} Fm^2$. assuming the internal field to be Lorentz field. Calculate the dielectric constant for the material if the material has $3 \times 10^{28} atoms/m^3$. **[7M]**

2. (a) Classify magnetic materials into para, dia and ferro, based on alignment of their magnetic moments and the temperature dependence of susceptibility. **[7M]**

   (b) Explain the origin of magnetic moment based on electron theory. What is Bohr magneton? Obtain an expression for it. **[7M]**

UNIT – II

3. (a) Why is an indirect band gap semiconductor not used in the construction of a semiconductor laser? Explain using an E-K diagram. **[7M]**

   (b) Describe the construction of semiconductor diode laser and explain its working with the help of energy level diagram. **[7M]**

4. (a) Give two examples of semiconductor materials used in the construction laser diodes. What is the band gap of a semiconductor material emitting a laser of wavelength 405 nm? **[7M]**

   (b) Mention the important differences between spontaneous and stimulated emission. Identify the active species/medium and the mechanism by which population inversion is achieved in the case of Ruby, He-Ne and semiconductor lasers. **[7M]**

UNIT – III

5. (a) Explain how different characteristics of nanomaterial can be determined using transmission electron microscopy. What different parameters can be found using this technique? **[7M]**

   (b) Discuss the effect of size reduction to nano scale on any four properties of a material. **[7M]**

6. (a) How to do the characterization of nanomaterial by XRD. Calculate the wavelength of X-rays which produce a first order maximum at an angle of 22° in a crystal with interplanar distance of 1.5 A° . **[7M]**

   (b) Explain quantum confinement nature of the nano material that drastically changes its properties compared to bulk materials. **[7M]**

UNIT – IV

7. (a) What is the meaning of ψ ? Set up the Schrodinger's time independent wave equation. **[7M]**

   (b) Calculate the first three energy values for an electron bound in an infinite potential well of width 5 nm. **[7M]**

8. (a) Obtain the Eigen energy values and Eigen energy functions for a particle bound in an infinite potential well. **[7M]**

   (b) Calculate the de Broglie wavelengths of an electron and a neutron both traveling at a speed of $10^6 ms^{-1}$. **[7M]**

UNIT – V

9. (a) What is Hall effect? Why do semiconductors exhibit higher Hall coefficient than metals? **[7M]**

   (b) What is Fermi energy? Show that the Fermi level lies midway between the valence and conduction band in an intrinsic semiconductor. **[7M]**

10. (a) Write a note on direct and indirect bang gap semiconductors. Give two examples for each. Explain why a direct band gap material is used for light emission? **[7M]**

    (b) Why does the resistance of a semiconductor decrease with increasing temperature? Estimate the electrical conductivity of intrinsic silicon at 300 K, given that the electron and hole mobilities are $\mu_e = 0.15\ m^2/Vs$ and $\mu_h = 0.05\ m^2/Vs$. The intrinsic carrier concentration is $1.2 \times 10^{16}/m^3$ at 300 K. **[7M]**