USN

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belgaum)

II Sem B.E. (Credit System) Mid Semester Examinations – I, January 2015

14PH102 – ENGINEERING PHYSICS

Duration: 1 Hour

Max. Marks: 20

*Note: Answer any **One** full question from **each Unit.***

List of constants: Velocity of light, $c=3\times10^{8}ms^{-1}$, Planck's constant, $h=6.63\times10^{-34}$ Js, Electron mass, $m=9.11\times10^{-31}$kg, Electron charge, $e=1.6\times10^{-19}$C, Permittivity of vacuum, $\varepsilon_o = 8.85\times10^{-12}$ F/m, Boltzmann constant, $k=1.38\times10^{-23}$J/K. Avogadro number, $N_A = 6.02 \times 10^{26}$ / k mole.

Unit – I

1. a) Define electric dipole moment. Explain the effect of electric field and temperature on dipoles in polar dielectrics. 03
   b) Obtain an expression for the internal field developed in solids and liquids when an external electric field is applied on it. Explain why internal field does not exist in gases. 04
   c) An elemental solid dielectric material has polarizability 7.5×10^{-40} Fm^2. Assuming the internal field to be Lorentz field, calculate the dielectric constant for the material if the material has 3×10^{28} atoms/m^3. 03

2. a) What are ferroelectrics? Discuss the properties of ferroelectric materials. 03
   b) Give a schematic sketch of the variation of the dielectric polarizabilities and dielectric loss as a function of the frequency and explain various contributions in different frequency ranges. 04
   c) What should be the voltage required to introduce a material of dielectric constant 4 between the plates of a parallel plate capacitor of area 1000 mm^2, having plate separation of 5 mm and a charge of 3×10^{-10} C. 03

Unit – II

3. a) Define Fermi level and explain with figure, its temperature dependence in a semiconductor doped with pentavalent impurities. 03
   b) Explain drift velocity and relaxation time and derive an expression for the electrical conductivity of a conductor in terms of relaxation time. 04
   c) Silver has 5.8×10^{28} conduction electrons/ m^3. Find the drift velocity of the conduction electrons if a current of 60mA flows through the silver wire of cross sectional area 0.2 mm^2, and also find the current density in it. If the applied electric field is 0.00476 V/m, evaluate the electrical conductivity of silver. 03

4. a) What are superconductors? Compare the dependence of resistance on temperature of a superconductor with that of a normal conductor. 03
   b) What is Hall effect? Discuss the physical origin of Hall effect and obtain the expression for hall voltage and mobility in terms of carrier concentration. 04
   c) Mobilities of electrons and holes in a sample of intrinsic germanium at 300K are $0.36m^2V^{-1}s^{-1}$ and $0.17m^2V^{-1}s^{-1}$ respectively. If the resistivity of the specimen is 2.12Ωm, compute the intrinsic carrier density. 03

****

USN

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belgaum)

II Sem B.E. (Credit System) Mid Semester Examinations - II, March 2015

14PH102 - ENGINEERING PHYSICS

Duration: 1 Hour

Max. Marks: 20

*Note: Answer any **One** full question from **each Unit.***

List of constants: Velocity of light, $c = 3\times10^{8}\ ms^{-1}$, Planck's constant, $h = 6.625\times10^{-34}$ JS, Electron mass, $m = 9.11\times10^{-31}$ kg, Electron charge, $e = 1.602\times10^{-19}$ C, Permittivity of vacuum, $\varepsilon_o = 8.854\times10^{-12}$ F/m, Boltzmann constant, $k = 1.38\times10^{-23}$ J/K, Avogadro Number, $N_A = 6.023\times10^{26}$ /mole.

Unit - I

1. a) LASER is the Light Amplification by the Stimulated Emission of Radiations. Explain. 3
   b) With necessary diagrams explain the principle, construction and working of Semiconductor diode laser. 4
   c) Calculate the number of photons emitted by the Nd:YAG laser of output power 1W. The lasing wavelength of the Nd:YAG laser is 1064 nm. 3

2. a) What is meant by attenuation in optical fiber? Explain the any two causes for attenuation. 3
   b) Discuss the conditions required for the laser action. Write any three difference between carbon dioxide laser and Nd:YAG laser. 4
   c) Calculate the refractive index of core of an optical fib[illegible]s numerical aperture is 0.27 and fractional index change is 0.015 3

Unit - II

3. a) What are X-rays? Explain the origin of continuous X rays. 3
   b) Define coordination number and atomic packing factor. Determine the atomic packing factor for BCC crystal by calculating number of atoms per unit cell and the atomic radius. 4
   c) Copper has FCC structure and its atomic radius is 1.273 Å. Find the lattice parameter and the density of copper (atomic weight of copper = 63.5 g). 3

4. a) Define unit cell and its parameters. Write a note on structural features of Diamond. 3
   b) What are miller indices? With an example explain the procedure to find miller indices. Draw (1 3 2) and (0 $\bar{1}$ 1) planes in cubic crystal system. 4
   c) An X-ray machine has an accelerating potential of 25KV. Find the shortest wavelength present in the X-ray spectrum and evaluate the energy of the photon. 3

****