Sections: G H I J K & L

USN

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belgaum)

I Sem B.E. (Credit System) Mid Semester Examinations – I October 2012

12PH102 – 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, $\varepsilon_0 = 8.85\times10^{-12}$ F/m, Boltzmann constant, $k=1.38\times10^{-23}$J/K.

Unit – I

1. a) What are dielectrics? What are their properties and applications? 03
   b) What is meant by electric polarization? Explain the electronic and orientational polarization mechanisms and their temperature dependence. 04
   c) Calculate the electronic polarisability of an isolated Ar atom if its atomic radius is 0.384 nm. Also calculate the dielectric constant if gas contains 3×10^{25} atoms per m^3 03

2. a) What are Piezo and Ferroelectric materials? Mention their properties and applications 03
   b) Discuss dielectric loss and dielectric breakdown 04
   c) What is the resulting voltage across the plates of a parallel plate capacitor with plates of area 360 cm^2, carrying a charge of 400nC and separated by a distance of 0.03mm, when a material of dielectric constant 8 is introduced between them ? Also determine the electric field. 03

Unit – II

3. a) Explain the terms (a) Drift velocity (b) Mean free path (c) Relaxation time (d) Mobility 03
   b) Based on free electron theory, derive an expression for the electrical conductivity of a conductor. Comment on the effect of temperature and impurities on the electrical conductivity of a conductor. 04
   c) A metal having 18×10^{28}conduction electrons per m^3. Find the relaxation time and mobility of conduction electrons if the metal resistivity is 2.8×10^{-8} ohm.m 03

4. a) What are semiconductors? Mention their properties? How do they differ from conductors? 03
   b) Discuss Fermi - Dirac distribution of electrons for different temperature conditions. 04
   c) Find the conductivity of intrinsic silicon sample at 300K, given that the density of intrinsic charge carriers at 300K in silicon is 2.5×10^{19} /m^3 and the mobilities of electrons and holes in silicon are 0.4 $m^2V^{-1}s^{-1}$ and 0.25 $m^2V^{-1}s^{-1}$ respectively. Also calculate the conductivity if donor type impurity is added to the extent of one impurity atom in 10^7 silicon atoms. Assume that, there are 10^{28} atoms/m^3 in the sample. 03

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Unit – I

1. a) Explain the terms stimulated emission, population inversion and pumping — 03
   b) With an energy level diagram, explain the construction and working of a CO_2 Laser. Write any four differences between CO_2 Laser and semiconductor Laser? — 04
   c) A source of Laser emits light of wavelength 632.8 nm and has an output power of 5 mW. How many photons are emitted in each minute by this laser when it is operating? — 03

2. a) Write a brief note on optical fibre sensors. — 03
   b) Explain with neat diagram the numerical aperture and ray propagation in an optical fibre. Arrive at the expression for numerical aperture. Mention the differences between single mode and multimode step index fibre. — 04
   c) Find the core radius necessary for single mode operation at 850 nm with V number 2.4 and with refractive indices of core and cladding 1.48 and 1.47 respectively. What is the numerical aperture and acceptance angle of the fibre? — 03

Unit – II

3. a) Define space lattice and unit cell. What are the lattice parameters of a unit cell? Name the seven crystal systems. — 03
   b) What are Miller indices? Explain the procedure of finding Miller Indices of a given plane with an example. What are the distinct features of Miller indices? — 04
   c) For a cubic lattice, draw (312) plane showing the value of intercepts with coordinate axis. Also find the atomic radius if its interplanar spacing is 1.0 A°. Assume that the lattice is BCC — 03

4. a) Write a note on the types of superconductors — 03
   b) Define coordination number. Calculate coordination number and atomic packing factor of BCC and FCC structures by calculating number of atoms/ unit cell and atomic radius. — 04
   c) Nickel has fcc structure with lattice constant 3.52Å. Obtain the miller indices of a plane whose intercepts are a, b/2, 3c along the three crystallographic axes in a cubic unit lattice. Also calculate the interplanar spacing. — 03

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