NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belgaum)

II Sem B.E. (Credit System) Mid Semester Examinations – I March 2013

12PH102 – ENGINEERING PHYSICS

Max. Marks: 20

Duration: 1 Hour

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's number is 6.025×10^{26} /kg. mole.

Unit – I

1. a) What are dielectrics? What are their properties and applications? — 03
   b) Discuss the polarizability in a dielectric material. Explain the frequency dependence of various polarizabilities and absorption losses. — 04
   c) Calculate the electronic polarisability of an isolated Ar atom if its atomic radius is 0.39 nm. Also calculate the dielectric constant if gas contains 3×10^{25} atoms per m^3 — 03

2. a) What are ferroelectric and piezoelectric materials? Discuss. — 03
   b) What is meant by electric polarization? Explain the electronic and orientational polarization mechanisms and their temperature dependence. — 04
   c) Sulphur is elemental solid dielectric whose dielectric constant is 3.87. Calculate the electronic polarizability if its density is 2.07×10^3 kg/m^3 and atomic weight is 32.07. — 03

Unit – II

a) Explain the terms (a) Drift velocity (b) Relaxation time (c) 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 1.8×10^{28} conduction electrons per m^3. Find the relaxation time and mobility of conduction electrons if the metal resisitivity is 2.7×10^{-8} ohm.m — 03

a) Discuss the principle, construction and working of Light Emitting Diode — 03
b) What is Fermi Factor? Discuss Fermi–Dirac distribution of electrons for different temperature conditions. — 04
c) Find the conductivity of intrinsic silicon at 330K. It is given that the density of intrinsic charge carriers at 330K in silicon is 1.55×10^{16} /m^3 and the mobilities of electrons and holes in silicon are 0.13 $m^2V^{-1}s^{-1}$ and 0.05 $m^2V^{-1}s^{-1}$ respectively. Also calculate the conductivity if donor type impurity is added to the extent of one impurity atom in 10^8 silicon atoms. Given: Number of atoms per unit volume of silicon is 5×10^{28} m^{-3} and neglect conductivity due to minority charge carriers. — 03

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Avogadro number, $N_A= 6.025\times10^{26}$/ k mole

Unit – I

a) Describe an optical fibre. What are its advantages over conventional cables in communication?   03

b) With energy level diagram explain the working of Nd:YAG laser. Distinguish between Nd:YAG laser and CO_2 laser.   04

c) The numerical aperture of an optical fiber is 0.24 when surrounded by air. Determine the refractive index of its core if the refractive index of cladding is 1.59. Also find the acceptance angle when it is in a liquid medium of refractive index of 1.35.   03

a) Explain the process of stimulated emission? Why it is important for lasing action?   03

b) What is attenuation in an optical fiber? Discuss different attenuation mechanisms.   04

c) The ratio of population of two energy levels out of which upper one corresponds to a metastable state is 1.055×10^{-30}. Find the wavelength of light emitted at 320K.   03

Unit – II

a) Explain with diagram, the salient features of Cesium Chloride crystal.   03
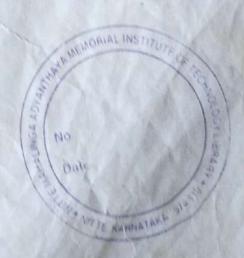
b) Define Miller Indices. Mention their features. Derive the expression for interplanar spacing in terms of Miller Indices.   04

c) An orthorhombic crystal has axial vectors in the ratio $a:b:c= 0.424 : 1 : 0.369$. Find the Miller indices of the crystal plane whose intercepts are in the ratio $0.424: \infty : 0.123$.   03

a) What are superconductors? Explain their properties.   03

b) Define Unit cell and What are its lattice parameters?
Define atomic packing factor. Obtain an expression for the same in case of BCC structure by calculating number of atoms per unit cell and atomic radius.   04

c) Calculate the density of diamond, given that the cube edge of its unit cell is 3.57 A^0 and atomic weight of carbon is 12.01.   03

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