c) The refractive index of the core and cladding are 1.48 and 1.45 respectively. Calculate the acceptance angle of the fiber. If the diameter of the fiber is 60 μm, find the number of modes the fiber can support at an operating wavelength of 1.5 μm.

6. a) Write a brief note on optical fiber sensors.
   b) Describe an optical fiber and its working principle. Obtain the expression for numerical aperture of an optical fiber.
   c) A Nd:YAG laser emits pulse of power of 1W and of duration 12ps. Calculate the number of photons in each pulse, if the laser wavelength is 1064nm.

**Unit – IV**

7. a) What are miler indices? With an example, explain the procedure to find miller indices.
   b) What are ultrasonics? Explain with a neat sketch how the flaw in a metal sheet is determined by nondestructive testing method.
   c) The inter planar spacing of (110) plane is 2Å for a FCC crystal. Find out the atomic radius.

8. a) Write a brief note on crystal structure of diamond.
   b) Explain the origin of continuous X rays. Obtain the Bragg's law to determine inter planar spacing in crystal.
   c) Electrons are accelerated by 344 V and are reflected from a crystal. The first reflection maximum occurs when the glancing angle is $60^0$. Determine the spacing of the crystal.

**Unit – V**

9. a) Give an account of duality of matter waves.
   b) Obtain the Eigen values, Eigen functions and the probability densities for a particle in one dimensional potential well of infinite height, considering the first three states.
   c) An electron is trapped in a one dimensional box of length $1 \times 10^{-10}$ m. How much energy must be supplied to excite the electron from the ground level to the second excited state?

10. a) Write a brief note on nano materials.
    b) What is self-assembly and self-organization of a nanostructure? Explain in brief and Lithography methods of nanofabrication process.
    c) Explain carbon nanotubes and its applications

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# NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belgaum)

**First Semester B.E. (Credit System) Degree Examinations**

**Make up Examinations – January 2015**

**14PH102 – ENGINEERING PHYSICS**

uration: 3 Hours Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

**ist 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=$6.022\times10^{26}$ /kg mol

## Unit – I

1. a) Distinguish between polar and nonpolar dielectrics. Explain with example, how the dielectric constant of a solid containing permanent dipoles vary with temperature. 06
   b) Discuss the local field in solid dielectrics and deduce the expression for the same. Give reason why in case of gases, the internal field is same as that of the applied field. 10
   c) A parallel plate capacitor of area 700mm$^2$and a plate separation 4mm has a charge of $2\times10^{-10}$ C on it. What is the resultant voltage across the capacitor when a material of dielectric constant 4 is introduced between them. Also calculate the polarization produced. 04

2. a) Give an account of the dielectric loss and show that it depends on the frequency of the applied field 06
   b) Explain any two types of polarization mechanisms in dielectrics and their frequency dependence of the applied field. 10
   c) An elemental dielectric material has a dielectric constant 12 and it contains $10^{22}$ atoms per mm$^3$. Calculate its electronic polarizability assuming the Lorentz field. 04

## Unit – II

3. a) Discuss the behaviour of conductivity of a conductor and a superconductor with temperature. 06
   b) Obtain the expression for Hall voltage in terms of current, magnetic field and carrier concentration by explaining the formation of Hall voltage. Also obtain the relation between Hall coefficient and mobility. 10
   c) What is the drift velocity and thermal velocity would an electron have in a material for which the mobility is 0 .78 m$^2$/Vs. Assume an electric field of 0.01 V/cm. 04

4. a) How a material in super conducting state does behave in the presence of a magnetic field. Explain the behaviour of a super conductor under high magnetic field. 06
   b) Describe, with sketches, how an electron current can be obtained by doping an intrinsic semiconductor. How does the Fermi level behave in this doped semiconductor with the increase in temperature? 10
   c) The Fermi level in a sample of potassium is 2.1 eV. What are the energies for which the probabilities of occupancy by electrons at 300K are 0.99 and 0.01. 04

## Unit – III

5. a) Explain the terms: (i) Population inversion (ii) Stimulated emission of radiation. Mention any four differences between a laser light and a conventional light. 06
   b) With necessary diagrams explain principle, construction and working of a Gallium Arsenide laser. Describe how the mechanism of lasing in semiconductor lasers is different from other lasers. 10

P.T.O.

14PH102

b) Describe the different types of optical fibers along with the typical core and cladd diameters, refractive index profile and mode of propagation sketches.

c) Calculate the energy difference in eV between the two energy levels of the Neon atoms a He-Ne gas laser, the transitions between which results in the emission of a light wavelength 632.8 nm. Also calculate the number of photons emitted per second, if optical power output is 2mW.

## Unit – IV

7. a) Explain space lattice. Describe briefly any four different crystal systems.
   b) Define coordination number &atomic packing factor. Determine the same for SCC a FCC crystal by calculating its atomic radius and number of atoms per unit cell.
   c) Find the miller indices of a set of parallel planes which make intercepts in the ratio 3a on X and Y axes and are parallel to Z axis. a, b and c being primitive vectors of the latti Sketch the plane in a cubic lattice and also calculate the interplanar spacing if the latt constant is 2.5 Å.

8. a) Explain the origin of continuous X rays.
   b) What are ultrasonics? What are their properties? Describe the procedure to find t velocity of ultrasonic waves in a given liquid by forming a liquid grating.
   c) A monochromatic X ray beam of wavelength 0.7Å undergoes first order Bragg's reflect from the plane (302) of a cubic crystal at a glancing angle of 35°. Calculate the latt constant.

## Unit – V

9. a) Discuss the concept of self-assembly and self-organization.
   b) Assuming Schrodinger's wave equation, obtain the solution for the allowed energy valu in the case of particle in a box and give energy level and wave function diagram.
   c) Find the energy of the electron in the first two excited state moving in a one dimens potential well of width 2Å of infinite height. Also calculate the wave function at x=a/2

10. a) What is wave function? Explain normalization of wave function and Eigen values.
    b) Discuss any one method each involved in top down & bottom up approach of na fabrication process.
    c) Write a note on scaling laws in miniaturization with examples in mechanical systems.

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# NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

## Second Semester B.E. (Credit System) Degree Examinations

April - May 2015

## 14PH102 – ENGINEERING PHYSICS

Duration: 3 Hours

Max. Marks: 100

*Note: Answer **Five full** questions choosing **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=$6.022\times10^{26}$ /kg mol

### Unit – I

1. a) What are dielectrics? Mention their properties and Applications? 06
   b) Describe the various mechanisms of polarization and the temperature effect. 10
   c) An air-filled parallel plate capacitor has a capacitance of 1.5pF. If the separation between the plates is doubled and wax is inserted between them, the capacitance increases to 4pF. Compute the dielectric constant of wax. Also calculate the charges stored on the plates of a capacitor with wax for a potential difference of 100V 04

2. a) What is dielectric breakdown? Give in detail, the various factors contributing to breakdown in dielectrics. 06
   b) With a neat sketch explain the behavior of dielectric constant in AC field and disappearance of various polarization mechanisms with relevant frequency ranges. 10
   c) The dielectric constant of Argon gas at NTP is 1.000435.Calculate the electronic polarizability of Argon atoms if the gas contains $3\times10^{25}$ atoms/$m^3$ and hence evaluate the radius of the atoms. 04

### Unit – II

3. a) Explain the terms drift velocity and relaxation time. 06
   b) Discuss the effect of magnetic field on superconductors. 10
   c) There is 2% probability that a state with an energy 0.35eV above Fermi level is occupied at a particular temperature. Determine the temperature. 04

4. a) What is a semiconductor? Mention any four differences between intrinsic and extrinsic semiconductors. 06
   b) Describe, with sketches, how an electron current can be obtained by doping an intrinsic semiconductor. How does the Fermi level behave in this doped semiconductor with the increase in temperature. 10
   c) Calculate the conductivity of aluminium at 25$^0$C using the given data. Density is 2.7 g/$cm^3$, atomic weight is 27 and the relaxation time of electrons is $10^{-14}$ s. 04

### Unit – III

5. a) With a neat sketch explain the requisites and conditions needed for laser action. 06
   b) Explain with necessary diagrams the construction and working of carbon dioxide laser. Write any three differences between gas laser and semiconductor laser. 10
   c) Calculate the acceptance angle and critical angle for the core-cladding interface when the core R.I. is 1.48 and fractional index change is 2%. 04

6. a) Explain how laser is used to read out data from the optical disc? 06

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14PH102

6. a) With neat sketches describe single mode fiber and graded index multimode fiber.
   b) Give general description of an optical fiber with the principle of working. Explain in b
   the different attenuation mechanisms in an optical fiber.
   c) The ratio of population of two energy levels in a laser system at 320 K is $10^{-30}$. Find th
   wavelength of the radiation emitted.

**Unit – IV**

7. a) What is an inter planar spacing in crystals? Derive an expression for inter planar spacing
   in terms of miler indices.
   b) Define coordination number and atomic packing factor. Determine the same for SCC and
   BCC crystal by calculating its atomic radius and number of atoms per unit cell.
   c) Draw the following planes in a cubic unit cell : (i) (101) (ii) (112) (iii) (132) (iv) $(0\bar{1}1)$

8. a) What are X rays? What are their properties? Mention its applications.
   b) What are ultrasonics? Describe the procedure of finding the velocity of ultrasonic waves in
   a given liquid by forming a liquid grating. Mention its applications.
   c) X rays are diffracted in the first order from a crystal with inter planar spacing of
   $2.82 \times 10^{-10}$ m at a glancing angle of 6°. Calculate the wavelength of X rays.

**Unit – V**

9. a) Explain in brief scaling laws in miniaturization in the case of mechanical and electrica
   system.
   b) Obtain the Eigen values, Eigen functions and the probability densities for a particle in one
   dimensional potential well of infinite height, considering the first three states.
   c) The wave function for a particle given by $\Psi = \sqrt{\frac{2}{a}} \sin\left(\frac{2\pi}{a}\right) x$. What is the probability o
   finding the particle between x=a/4 and x=3a/4.

10. a) What is wave function? Explain normalization of wave function and Eigen values.
    b) Explain the synthesis of nanostructured materials using physical vapor phase technology.
    c) Write a note on carbon nanotubes and its applications.

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# NMAM INSTITUTE OF TECHNOLOGY, NITTE

*(An Autonomous Institution affiliated to VTU, Belagavi)*

**First / Second Semester B.E. (Credit System) Degree Examinations**

**Make up / Supplementary Examinations – July 2015**

Duration: 3 Hours

**14PH102 – ENGINEERING PHYSICS**

Max. Marks: 100

*Note: Answer **Five full** questions choosing **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$=6.022\times10^{26}$/kg mol

## Unit – I

1. a) Give the details of solid, liquid and gaseous dielectric materials with examples. 06
   b) Explain the phenomenon of polarization in polar and nonpolar dielectrics. Discuss the electronic and orientational polarization mechanisms and their temperature dependence 10
   c) A parallel plate capacitor has a capacitance 100microfarad.The dielectric has a relative permittivity 4. For an applied voltage of 5V, calculate the energy stored in the capacitor as well as the energy stored in the polarizing dielectric. 04

2. a) Write a note on ferroelectric materials. 06
   b) Give an account of dielectric loss and describe the frequency dependence of dielectric constant. 10
   c) A solid contains $5\times10^{22}$ identical atoms per $mm^3$ each with a polarizabilty $2\times10^{-40}$ $Fm^2$. Assuming the internal field given by the Lorentz relation, calculate the ratio of internal field to the applied field 04

## Unit – II

3. a) Applying magnetic field and electric field mutually perpendicular to each other is responsible for setting up of hall voltage how. Obtain the expression for the same in terms of carrier concentration. 06
   b) Discuss the effect of magnetic fields on superconductors. 10
   c) The superconducting material tin has a critical temperature at 3.7K. If the critical field of the material at 0K is 0.0306 find the critical field at 2K. 04

4. a) Conductors, semiconductors and insulators are differentiated on the basis of forbidden energy gap, explain in brief the band formation. 06
   b) At high temperatures extrinsic semiconductors behave like intrinsic semiconductors explain. 05
   c) Give an account of Fermi Dirac distribution of electrons at various temperatures. 05
   d) There are $10^{20}$ conduction electrons/$m^3$ in a material having resistivity 0.01 Ohm.m. Find the charge mobility and the electric field needed to produce a drift velocity of 1m/s 04

## Unit – III

5. a) Discuss the possible ways through which radiation interacts with matter. 06
   b) Explain with principle, construction and working of a $CO_2$ laser with the necessary diagrams. Write any two applications of it. 10
   c) A glass clad fiber is made with core glass of refractive index 1.5 and the cladding is doped to give a fractional index difference of 0.05. Determine (a) the acceptance angle (b) the numerical aperture and (c) the critical internal reflection angle. 04

P.T.O.

c) Superconducting tin has a critical magnetic field of 217 gauss at 2 K. If the critical temperature for superconducting tin is 3.7 K, find the critical magnetic field at 3 K. 6 L2

## Unit – III

5. a) Explain interaction of light with matter that leads to Induced absorption and spontaneous emission. 10 L3

b) With a neat sketch describe with principle the construction and working of He-Ne laser. 4 L4

c) Calculate the number of photons emitted per second by a He-Ne Laser source emitting light of wavelength 6328Å with an output power of 10mW. 6 5

6. a) For a coherent laser light stimulated emission is ideal. Explain. 10 3

b) What is attenuation? Explain types of losses in an optical fiber that leads to attenuation. Distinguish single mode and multimode fiber.

c) A glass clad fiber is made with core glass of refractive index1.5 and cladding is doped to give a fractional index change of 0.0005. Determine the cladding index, the critical internal reflection angle. 4 4

## Unit – IV

7. a) What are Miller indices? Explain the procedure followed to specify a crystal plane by using Miller indices, with an example. 06 L1 L4

b) Derive Bragg's law for X-ray diffraction in crystals. Describe how Bragg's X-ray spectrometer is used to determine the crystal structure. 10 L4 L2

c) Deduce the Miller indices of a plane which cuts off intercepts in the ratio a:2b:-3c along the three axes, where a,b,c are primitive vectors and hence sketch the plane in cubic lattice. 04 L4

8. a) Define atomic packing factor and coordination number. Calculate the same for BCC structure by calculating number of atoms per unit cell and atomic radius. 06 L1 L4

b) Describe with suitable diagram any four types of crystal systems. Explain the crystal structural of ZnS. 10 L2 L4

c) Calculate the density of diamond, given that the cube edge of its unit cell is 3.57Å, and the atomic weight of carbon is 12.01. 04 L4

## Unit – V

9. a) Explain the self-assembly and self organization of nanostructure materials. 6 L3

b) What is Top- down approach? Explain the Synthesis of nanoparticle by ball milling method and nanolithography.

c) An electron is bound in an one dimensional potential well of width 0.12nm. Find the energy values in the ground state and also the first two excited states in eV 10 L2

10. a) Explain dual nature of matter and arrive at the concept of matter waves. 4 L4

b) Derive an expression for energy eigen value for an electron in a potential well of infinite height. 6 L2

c) Calculate the zero point energy in eV for an electron in a box of width $10\,\mathring{A}$ 10 L3 4 L4

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# NMAM INSTITUTE OF TECHNOLOGY, NITTE

*(An Autonomous Institution affiliated to VTU, Belagavi)*

## First Semester B.E. (Credit System) Degree Examinations

November - December 2015

## 15PH102 – ENGINEERING PHYSICS

ion: 3 Hours

Max. Marks: 100

of constants: Velocity of light, $c = 3 \times 10^8 ms^{-1}$, Planck's constant, $h = 6.63 \times 10^{-34}$ Js, Electron mass, $m=9.11 \times 10^{-31}$kg, Electron charge, $e=1.6 \times 10^{-19}$C, Permittivity of vacuum, $\varepsilon_0 = 8.85 \times 10^{-12}$F/m, Boltzmann constant, $k=1.38 \times 10^{-23}$J/K Avogadro number, $N_A = 6.023 \times 10^{26}$ / k mole.

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

| | | Marks | BT* |
|---|---|---|---|
| | **Unit – I** | | |
| a) | Define polarization and discuss any two mechanisms of polarization | 06 | L*2 |
| b) | Explain the term dielectric loss. Discuss the frequency dependence of various polarisabilities and absorption losses | 10 | L4 |
| c) | The electronic polarizability of Argon atom is $1.45 \times 10^{-40}$ Fm$^2$. Find the induced dipole moment and the relative shift in the electron cloud when it is subjected to an electric field of 100kV/m. Given : Atomic number of Argon is 18 | 04 | L3 |
| a) | What are ferro and piezoelectric materials? Mention their properties and uses | 06 | L1 |
| b) | Define the term internal field and show that the field intensity at the atom of a solid or a liquid dielectric is greater than the applied field | 10 | L6 |
| c) | A parallel plate condenser has a capacitance of 2μF.The dielectric has a relative permittivity of 100. For an applied voltage of 100V, find the energy stored in the condenser. Also show that, for a field strength of E, the stored energy in the polarised atom is equal to ½ $\alpha E^2$ , where α is polarizability. | 04 | L3 |
| | **Unit – II** | | |
| a) | Name the different applications of superconductors. Explain BCS theory of superconductivity. | 06 | L1 |
| b) | Explain carrier generation in an extrinsic semiconductor hence obtain an expression for its electrical conductivity. With necessary diagrams, explain the effect of temperature on conductivity and the Fermi level. | 10 | L2 |
| c) | What is the mobility of conduction electrons in copper which has resistivity of 1.6x10-8 Ωm and electron density of $8.5 \times 10^{28}/m^3$. Also find relaxation time. | 04 | L3 |
| a) | How does the electrical resistivity of a metal vary with impurity and temperature? | 06 | L4 |
| b) | What is Hall effect? Obtain an expression for the carrier concentration in terms of Hall voltage. What are the applications of Hall effect? | 10 | L2 |

P.T.O.