Unit – V

a)	What is a wave function? Give its physical significance and properties.	6	L1 L2
b)	Solve the Schrodinger wave equation for the allowed energy values in the case of a particle in a potential well of infinite height.	10	L3
c)	The ground state energy of an electron in a one dimensional infinite potential well of width 1 Å is 16eV. Calculate the energy of the electron in the third excited state.	4	L4
a)	Obtain time independent Schrodinger wave equation for a particle in one dimension.	6	L3
b)	What are nanomaterials? Explain the synthesis of nanoparticle by Bottom-up approach using physical vapor deposition method and sputtering method.	10	L1,L3
c)	Discuss mechanical scaling laws.	4	L2

loom's Taxonomy, L* Level

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b) What are superconductors and how are they classified? Compare the characteristics of Type I and Type II superconductors. 10 L2

c) A uniform wire has a cross sectional area of 1x10-6 m2 and an electron density of 8.5x1028 m-3. What will be the drift velocity of conduction electrons if a current of 2 A flows through it? 04 L3

Unit – III

5. a) The Length of the resonating column of a Laser for good lasing action is always an integral multiple of Λ/2. Explain 06 L5

b) Explain with suitable diagrams the construction and working of a semiconductor laser. 10 L3

c) Find the population of two energy states of a laser the transition between which is responsible for the emission of photon of wavelength 693.3 nm at ambient temperature. 04 L4

6. a) Explain the term Numerical aperture of an optical fiber and obtain the expression for the same. 06 L2

b) Explain the principle and discuss the light propagation through an optical fiber. What are the advantages of optical communication system over that of conventional cable system? 10 L

c) The angle of acceptance of an optical fiber is 30^0 when kept in air. Find the angle of acceptance when it is in a medium of refractive index1.33. 04 L

Unit – IV

7. a) Define space lattice, unit cell and lattice parameters. Derive Bragg's law for X-ray diffraction in crystals. 06 L

b) Define atomic packing factor. Calculate atomic packing factor for Simple Cubic, BCC and FCC structures by calculating number of atoms/ unit cell and atomic radius. Which type of the cubic crystal structure has closest packing of atoms? 10 L

c) Calculate the energy of electrons that produces first order Bragg's diffraction at an angle of 22˚ when incident on crystal with interplanar spacing of 1.8 Å. 04 L

8. a) What are Miller indices? Derive an expression for the interplanar spacing in terms of Miller indices. 06 L

b) What is meant by nondestructive testing? Describe the principle employed in nondestructive testing by using ultrasonics. Describe in detail how a flaw in solid material is detected by nondestructive method using ultrasonics. 10 L

c) Copper has FCC structure and its atomic radius is 1.278 Å. Find the lattice parameter and density of copper. Given: Atomic weight of Copper is 63.5 and Avogadro number, NA = 6.023×10^{26} / k mole. 04 L

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Make up Examinations – January 2016

15PH102 – ENGINEERING PHYSICS

Duration: 3 Hours

Max. Marks: 100

List of constants: Velocity of light, $c = 3 \times 10^8 ms^{-1}$,
Electron mass, $m=9.11\times10^{-31}$kg,
Permittivity of vacuum, $\varepsilon_0 = 8.85\times10^{-12}$ F/m,
Avogadro number, $N_A = 6.023 \times 10^{26}$ / k mole.
Planck's constant, $h = 6.63 \times 10^{-34}$ Js,
Electron charge, $e=1.6\times10^{-19}$C,
Boltzmann constant, $k=1.38\times10^{-23}$J/K

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

Unit – I

			Marks	**BT***
1.	a)	What are dielectric materials? Discuss the effect of electric filed on them. Mention any four applications	06	L*1 L2
	b)	Explain dielectric loss and breakdown of dielectrics. Show that dielectric loss is a function of applied frequency	10	L2,L6
	c)	What is the resulting voltage across the plates of a parallel plate capacitor with plates of area 10^{-3} m^2, carrying a charge of 9×10^{-11} C and separated by a distance of 5mm, when a material of dielectric constant 6 is introduced between them. Also calculate the polarization produced.	04	L4
2.	a)	Discuss any two properties of ferroelectric materials. Mention any four applications.	06	L1
	b)	Explain the concept of internal field in a solid dielectric material. Obtain Clausius – Mosotti formula relating macroscopic dielectric constant and microscopic polarizabilities.	10	L1,L6
	c)	A dielectric material containing 10^{28} atoms/m^3 shows an internal field which is 1.6 times the applied filed. If the internal field is Lorentz type, calculate the polarizability associated with each atom.	04	L4

Unit – II

3.	a)	Name the different applications of superconductors. Explain in detail the construction and working of a cryotron.	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 8.5x1028 m-3. Also find the relaxation time of conduction electrons.	04	L3
4.	a)	Define Fermi factor and Fermi energy for a semiconductor. Evaluate the Fermi factor and show that it is equal to 0.5 at Fermi level.	06	L4

c) Calculate the resistivity of intrinsic germanium if intrinsic carrier density is $2.5 \times 10^{19}\ m^{-3}$. Assume the electron and hole mobility to be $0.38\ m^2V^{-1}s^{-1}$ and $0.18\ m^2V^{-1}s^{-1}$ respectively.

Unit – III

5. a) Explain what is stimulated emission and how is it achieved.

   b) Explain with a neat sketch the construction and working of ruby Laser. Distinguish between ruby Laser and He-Ne Laser.

   c) Transition occurs between a metastable state E_3 and an energy state E_2 just above the ground state. If emission is at 1.1μm and E_2 is 0.4×10^{-19} J, find the energy of the E_3 state.

6. a) What is Laser? Mention its properties and applications.

   b) What is attenuation in optical fiber? Explain different types of attenuation in an optical fiber. Explain the characteristic features stepindex single mode fiber.

   c) The attenuation of light in an optical fiber is estimated as 2.2 dB/Km. What fractional initial intensity remains after 2000 m?

Unit – IV

7. a) What are X-rays? Mention any four properties of X-rays. Explain the origin of continuous X-rays.

   b) Define coordination number and atomic packing factor. Calculate coordination number and atomic packing factor of BCC and FCC structures by calculating number of atoms/ unit cell and atomic radius.

   c) Interplanar distance for a crystal is 3 Å and the glancing angle for the second order Bragg's reflection is $10^\circ\ 30'$. Find the wavelength of X rays and the glancing angle for third order reflection.

8. a) Describe with suitable diagrams the crystal structure of Diamond.

   b) What are ultrasonics? Write any four properties of ultrasonics. Describe with theory the acoustic grating method of measurement of velocity of ultrasonic waves in a liquid.

   c) If the lattice constant of iron is 2.87 Å with an atomic weight 55.85 and density $7.85\text{x}10^3 kg/m^3$ respectively, find the type of the sublattice to which it belongs.

Unit – V

9. a) What is Wave function? Give its physical Significance and properties.

   b) What are nonmaterials? Explain Carbon nanotubes and their properties. Mention few applications of carbon nanotubes.

   c) The ground state energy of an electron in an infinite potential well is 5.6meV. If the width of the well is doubled, calculate its ground state energy.

10. a) What is Bottom-up approach? How the nanoparticels synthesized by Physical vapor deposition method.

    b) Assuming the time independent Schrodinger wave equation, discuss the solution for a particle in one dimensional potential well of infinite height. Hence obtain the normalized wave function.

    c) An electron is bound in an one dimensional potential well of width $1A^o$, but of infinite height. Find the energy value for the electron in the ground state in eV

BT* Bloom's Taxonomy, L* Level

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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 2016

15PH102 – ENGINEERING PHYSICS

Duration: 3 Hours

Max. Marks: 100

List of constants: Velocity of light, $c = 3 \times 10^8 ms^{-1}$, Planck's constant, $h = 6.63 \times 10^{-34}$ Js,
Electron mass, $m=9.11x10^{-31}$kg, Electron charge, $e=1.6x10^{-19}$C,
Permittivity of vacuum, $\varepsilon_0 = 8.85x10^{-12}$F/m, Boltzmann constant, $k=1.38x10^{-23}$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.***

		Unit – I	Marks	BT*
1.	a)	What is meant by dielectric loss? Show that the dielectric loss depends on the frequency of the applied field.	06	L2
	b)	Discuss different polarization mechanisms and explain their temperature dependence	10	L2
	c)	The dielectric constant of sulphur is 3.5. Assuming a cubic lattice for its structure, calculate the electronic polarizability of sulphur. Given for sulphur, density = $2.07x10^3$ kg/m^3 and atomic weight = 32.07.	04	L3
2.	a)	What is dielectric breakdown? Explain the various factors contributing to dielectric breakdown.	06	L2
	b)	Define dipolar relaxation. Discuss the behavior observed in dielectrics subjected to an alternating electric field.	10	L4
	c)	Write a note on the types of dielectric materials by giving examples for each class.	04	L4
		Unit – II		
3.	a)	Mention the characteristics of a superconducting phase. Explain Meissner effect and show how it indicates that superconductor is a perfect diamagnetic material.	06	L1
	b)	What is an intrinsic semiconductor? Obtain an expression for the conductivity of an intrinsic semiconductor. Discuss the effect of temperature on the conductivity and hence show how the band gap of the semiconductor can be determined.	10	L2
	c)	Electrical conductivity of an intrinsic semiconductor increases from 19.96 $\Omega^{-1}m^{-1}$ to 79.44 $\Omega^{-1}m^{-1}$ when the temperature is increased from 60 to 100° C. Find the band gap of the semiconductor.	04	L3
4.	a)	What are extrinsic semiconductors? Obtain an expression for the electrical conductivity of an extrinsic semiconductor.	06	L4
	b)	On the basis of Drude-Lorentz theory, obtain an expression for the electrical conductivity of a metal. What are its demerits?	10	L2

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Unit – III

5. a) Discuss the conditions for a good lasing action.

   b) Distinguish conventional light and laser light. Describe the construction and working of a ruby laser.

   c) A pulsed laser emits photons of wavelength 780 nm with 20 mW average power per pulse. Calculate the number of photons contained in each pulse if the pulse duration is 10ns.

6. a) Describe the salient feature of a graded index fiber and explain the wave propagation through it with necessary figures.

   b) Describe an optical fiber. With a neat sketch explain the principle and wave propagation through a fiber. Obtain the expression for numerical aperture. Define angle of acceptance and modes.

   c) Calculate the number of modes that a fiber can support for propagation if the core diameter of the fiber is 40 μm and the refractive indices of 1.55 and 1.50 respectively for core and cladding. A source of light with wavelength 1400 nm is used.

Unit – IV

7. a) Explain the origin of continuous and characteristic X-ray spectra.

   b) Explain the terms space lattice and lattice parameters. Define and calculate the atomic packing factor for BCC and FCC structure by calculating number of atoms/unit cell and atomic radius.

   c) A monochromatic X-ray beam of wavelength 1Å undergoes first order Bragg reflection from the plane (211) of a cubic crystal at a glancing angle of $54^{\circ}\ 44^{\prime}$. Calculate the lattice constant.

8. a) Define interplanar spacing and hence deduce a relation between an interplanar distance 'd' and the Miller Indices of the planes for cubic lattice.

   b) Write any four properties of ultrasonics. Describe with theory the acoustic grating method of measurement of velocity of ultrasonic waves in a liquid and elastic constant of the liquid medium.

   c) Find the Miller indices of a set of parallel planes which make intercepts in the ratio 3a:4b and parallel to Z-axis. Also calculate the interplanar distance of the planes taking the lattice to be cubic with lattice constant 2Å.

Unit – V

9. a) Set up the time independent Schrodinger wave equation for a particle in one – dimension.

   b) What is Bottom-up approach? How the nanoparticles are synthesized by Physical Vapor deposition method and sputtering method?

   c) An electron is bound in a one dimensional potential well of width $1.2\overset{0}{A}$. Find the energy value in ev and de-Broglie wave length in the first excited state.

10. a) Explain Carbon nanotubes and its applications by giving their physical properties.

    b) Using Schrodinger wave equation for a particle in one dimensional potential well of infinite height, discuss about energy eigen values.

    c) A quantum particle confined to one dimensional box of width 'a' is in its first excited state. What is the probability of finding the particle over an interval of $\left({}^{a}\!/_{2}\right)$ marked symmetrically at the centre of the box.

BT* Bloom's Taxonomy, L* Level

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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 2016

15PH102 – ENGINEERING PHYSICS

ration: 3 Hours

Max. Marks: 100

st of constants: Velocity of light, $c = 3 \times 10^{8} ms^{-1}$, Planck's constant, $h = 6.63 \times 10^{-34}$ Js,
Electron mass, $m=9.11x10^{-31}$kg, Electron charge, $e=1.6x10^{-19}$C,
Permittivity of vacuum, $\varepsilon_0 = 8.85x10^{-12}$F/m,
Boltzmann constant, $k=1.38x10^{-23}$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.***

Unit – I

		Marks	BT*
a)	Define the terms electric dipole moment and polarization. Distinguish between polar and nonpolar dielectrics.	6	L*2
b)	Discuss the different mechanisms of polarization and sketch their dependence on the frequency of the applied field.	10	L5
c)	Two parallel plates have equal and opposite charges and are separated by a dielectric of 5mm thick and dielectric constant of 3. If the electric intensity in the dielectric is 10^{6} v/m, calculate i) free charges per unit area on the conducting plates ii) flux density and iii) polarization	4	L3
a)	How does the dielectric constant of material containing permanent dipoles vary with temperature? Illustrate your answer with an example.	6	L2
b)	Describe the properties of Ferro and Peizoelectric materials. Give examples for each class.	10	L2
c)	Calculate the dielectric constant at optical frequencies of FCC ionic solid if its lattice parameter is 0.63nm. The electronic polarizability of anion is $1.26x10^{-40}$ $Fm^2$and that of cation is $3.41x10^{-40}Fm^2$.	4	L5

Unit – II

		Marks	BT*
3. a)	Define Fermi level for a semiconductor. Explain the effect of temperature on the Fermi level of an n-type semiconductor.	6	L2
b)	Derive an expression for the conductivity of a metal based on the classical free electron theory. What are the assumptions made in the theory? Mention the demerits of the theory.	10	L4
c)	The critical temperature and the critical magnetic field for superconducting lead are 7.2 K and 800 gauss respectively. What will be the temperature up to which lead will be superconducting in a magnetic field of 400 gauss?	4	L3
4. a)	Explain the terms drift velocity, relaxation time and mean free path of electrons in a metal. How are they related to each other?	6	L2
b)	What is Hall Effect? Describe an experiment to determine the carrier concentration of a semiconductor using Hall effect. Derive the expression used.	10	L2
c)	A uniform wire has an electron density of $6x10^{28}$ m^{-3} and a resistivity of $2x10^{-8}$ Ωm at room temperature. For an electric field of 200 Vm^{-1} along the wire, compute the drift velocity and mobility of carriers.	4	L3

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b) Based on free electron theory, derive an expression for electrical conductivity of metals. How does electrical resistance change with impurity and temperature? 10

c) An N-type semiconductor has a Hall coefficient of 3.66×10^{-4} m^3/C and its resistivity is found to be 2.12 ohm-m. Calculate charge carrier concentration and electron mobility at room temperature. 4

Unit – IV

7. a) Explain Einstein's theory of stimulated emission. How does the theory predict the existence of stimulated emission? 6

b) What are the different modes of propagation possible in optical fibers. Explain in detail their characteristic features with necessary diagrams. 10

c) A He-Ne laser has an output power of 10 mW and emits light at a wavelength of 632.8 nm. How many photons are emitted by the laser in each second? 4

8. a) Obtain an expression for the numerical aperture of an optical fiber in terms of the refractive indices of the core and cladding and also in terms of relative refractive index difference. 6

b) What is a laser? Describe the construction of a He-Ne laser and its working with necessary energy level diagram. 10

c) An optical fiber has its core and cladding made of materials having refractive index 1.45 and 1.40 respectively. Find the numerical aperture and the angle of cone of acceptance for the fiber. 4

Unit – V

9. a) Explain Piezoelectric effect with an example. 6

b) Mention any two methods of producing ultrasonic waves and explain the application of ultrasonic waves, in nondestructive testing of materials. 10

c) What are nano-materials? Mention two applications of nano-materials. 4

10. a) Explain the types of Superconductors. 6

b) Explain the classification of magnetic materials? Discuss the properties of a ferromagnetic material as a function of external magnetic field. 10

c) A magnetic field of 1000 A/m is applied to a material which has a susceptibility of 1000. Calculate (1) relative permeability and (2) Flux density. 4

BT* Bloom's Taxonomy, L* Level

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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 2016

16PH102 – 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, $\varepsilon_0 = 8.85\times10^{-12}$ F/m, Boltzmann constant, $k=1.38\times10^{-23}$J/K.
Permeability of free space , $\mu_0=1.26\times10^{-6}$wb/Am
Avogadro Number, $N_A=6.022\times10^{26}$ / Kgmole.

		Unit – I	**Marks**	**BT***
1.	a)	What are matter waves? Mention their characteristics.	6	L*2
	b)	Solve Schrodinger's wave equation for a particle in an infinitely deep potential well of width L and show that the energy values are quantized.	10	L4
	c)	An electron beam is subjected to a potential of 10^3 volts. Find the de Broglie wavelength associated with the electrons.	4	L3
2.	a)	What is a wave function? Mention its characteristics.	6	L2
	b)	Derive Schrodinger's time independent wave equation in one dimension for a particle of mass m with energy E.	10	L4
	c)	An electron is bound in a one dimensional potential well of width 10 nm, of infinite wall height. Find its first three energy values.	4	L3
		Unit – II		
3.	a)	What is a space lattice? Describe any 3 crystal systems	6	L3
	b)	Explain Miller Indices. Derive an expression for interplanar spacing in a crystal in terms of Miller indices.	10	L3
	c)	The interplanar spacing of (100) planes is 2Å for a simple cubic crystal. Find the atomic radius.	4	L4
4.	a)	Describe sodium chloride crystal structure.	6	L2
	b)	Describe Bragg's spectrometer and explain how crystal structure of sodium Chloride crystal structure is determined using Bragg's spectrometer.	10	L3
	c)	The minimum order Bragg's reflection occurs at an angle of 20° for the plane (212). Find the wavelength of x- rays used if the lattice constant is 3.615Å.	4	L4
		Unit – III		
5.	a)	What are the drawbacks of classical free electron theory of metals? What are the assumptions made in quantum theory to overcome the same?	6	L2
	b)	What is Hall effect? Explain how Hall field is induced in a n-type semiconductor and obtain an expression for the Hall coefficient, Hall voltage and mobility of charge carriers.	10	L4
	c)	Find the temperature at which there is 2% probability that a state at energy 0.3 eV above Fermi level will be occupied.	4	L3
	a)	Define Fermi factor. Discuss the probability of occupation of various energy states by electrons at T = 0K and T > 0K on the basis of Fermi factor	6	L3

P.T.O.