6.	a)	Explain the terms 1) Optical fiber 2) Numerical aperture and 3) Fractional index change.	6	L2	3
	b)	What is power loss in an optical fiber? Mention the possible reasons for the power loss in an optical fiber.	10	L2	3
	c)	Calculate the V-number for a fiber of core diameter 40 μm and with refractive indices of 1.55 and 1.50 respectively for core and cladding, when the wavelength of the propagating wave is 1400 nm. Also calculate the number of modes that the fiber can support for propagation. Assume that the fiber is in air.	4	L3	3

Unit – IV

7.	a)	Discuss the probability of occupation of various energy states by electrons at T = 0 K and T > 0 K on the basis of Fermi factor.	6	L2	4
	b)	On the basis of classical free electron theory, derive an expression for the electrical conductivity of a metal.	10	L2	4
	c)	What is the mobility of electrons in copper which has resistivity 1.6×10^{-8} ohm-m and electron density of 8.5×10^{28} m^{-3} ?	4	L3	4
8.	a)	Explain the terms 1) Drift velocity 2) Mobility and 3) Relaxation time.	6	L1	4
	b)	Discuss effect of magnetic field and Meissner effect in superconductors. Explain the magnetic behaviour of Type-I and Type-II superconductors.	10	L2	4
	c)	Calculate the probability of an electron occupying an energy level 0.03 eV above Fermi level at 300 K.	4	L3	4

Unit – V

9.	a)	Explain the effect of temperature on the conductivity of an intrinsic semiconductor.	6	L2	5
	b)	Obtain an expression for the conductivity of an extrinsic semiconductor. Discuss the effect of temperature on the Fermi level in a n-type semiconductor?	10	L2	5
	c)	Mobilities of electrons and holes in a sample of intrinsic germanium at 300K are $0.34 m^2V^{-1}s^{-1}$ and $0.18\ m^2V^{-1}s^{-1}$ respectively. If the resistivity of the specimen is 2.14 Ωm, compute the intrinsic carrier density.	4	L3	5
10.	a)	Compare the characteristics of intrinsic and extrinsic semiconductors.	6	L2	
	b)	Explain the construction and working of a solar cell.	10	L2	
	c)	The mobility and charge carrier concentration of the specimen are $0.041\ m^2/Vs$ and $1.7 \times 10^{22}/m^3$ respectively. Calculate Hall co-efficient and resistivity of the specimen.	4	L3	

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

****

USN

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

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

April – May 2019

18PH102 – 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,
Boltzmann constant, $k=1.38\times10^{-23}$J/K.
Avogadro number, $N_A = 6.022 \times 10^{26}$/ kg mole.

Unit – I

			Marks	BT*	CO*	PO*
1.	a)	Define group velocity. Obtain an expression for the same.	6	L*1	1	1
	b)	Solve the Schrödinger's wave equation for a particle in one dimension potential well of infinite height and discuss about energy Eigen values.	10	L2	1	1,2
	c)	Calculate the de-Broglie wavelength associated with an electron with a kinetic energy of 2 keV.	4	L3	1	1,2
1.	a)	What are matter waves? Mention their characteristics.	6	L2	1	1,2
	b)	Obtain an expression for one dimensional time independent Schrodinger's wave equation.	10	L2	1	1,2
	c)	An electron is bound in a one dimensional potential well of width 4 Å, but of infinite wall height. Find its Zero point energy.	4	L3	1	1,2

Unit – II

			Marks	BT*	CO*	PO*
	a)	What is space lattice? With neat diagrams, explain any three crystal systems.	6	L2	2	1
	b)	Define coordination number and atomic packing factor. Determine the atomic packing factor for the case of body centered cubic (BCC) lattice by calculating number of atoms/unit cell and obtaining relation between atomic radius and lattice constant.	10	L2	2	1,2
	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.	4	L3	2	1,2
	a)	What are X-rays? With necessary diagrams, explain the origin of characteristic X-rays.	6	L1	2	1
	b)	Derive Bragg's law for X-ray diffraction. Explain in detail Bragg's X-ray spectrometer.	10	L3	2	1,2
	c)	A X-ray machine has an accelerating potential of 25 kV. Find the shortest wavelength present in the X-ray spectrum. Also calculate the energy of the X-ray photon.	4	L3	2	1,2

Unit – III

			Marks	BT*	CO*	PO*
	a)	Write a note on spontaneous emission and stimulated emission.	6	L2	3	1
	b)	Describe the construction and working of a Semiconductor laser with neat diagrams.	10	L2	3	1
	c)	The ratio of population of two energy level is 1.059×10^{-30}. Calculate the wavelength of the emitted photon at 300 K.	4	L3	3	1,2

P.T.O.

	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. Find (a) the numerical aperture (b) the acceptance angle and (c) the critical internal reflection angle.	4	L3	3
6.	a)	What is attenuation in an optical fiber? Explain in brief the factors contributing to the fiber losses.	6	L2	3
	b)	With a neat diagram explain the ray propagation, angle of acceptance, and numerical aperture in an optical fiber. Derive an expression for numerical aperture of an optical fiber in terms refractive indices of core and cladding.	10	L3	3
	c)	Find the ratio of population of the two energy states, the transition between which is responsible for the emission of photons of wavelength 694.3 nm. Assume the ambient temperature as 27 °C.	4	L3	3

Unit – IV

7.	a)	Mention the important differences between classical free electron theory and quantum free electron theory.	6	L2	4
	b)	Obtain an expression for the electrical conductivity of a metal based on the classical free electron theory.	10	L2	4
	c)	Find the temperature at which there is 2% probability that a state with an energy 0.3 eV above Fermi energy is occupied.	4	L3	4
8.	a)	Explain the effect of impurity and temperature on the electrical resistivity of metals.	6	L2	4
	b)	Discuss critical field and Meissner effect in superconductors. Explain the magnetic behaviour of Type-I and Type-II superconductors.	10	L2	4
	c)	Calculate the drift velocity and thermal velocity of conduction electrons in a metal of 1 mm thickness across which a potential of 1 volt is applied at a temperature of 300 K. Given the mobility of free electrons is $4 \times 10^{-3}\ m^2V^{-1}s^{-1}$.	4	L3	4

Unit – V

9.	a)	Explain the effect of temperature on the Fermi level in an extrinsic n-type semiconductor?	6	L2	5
	b)	Derive an expression for the electrical conductivity of an intrinsic semiconductor in terms of carrier concentration and carrier mobilities	10	L2	5
	c)	An N-type semiconductor has a Hall coefficient of $3.66\times10^{-4}m^3C^{-1}$ and its resistivity is found to be 2.12 ohm-m. Calculate charge carrier concentration and electron mobility at room temperature	4	L3	5
10.	a)	With the help of energy level diagrams, explain the formation of a potential barrier in a p-n junction.	6	L2	5
	b)	What is Hall effect? Explain the production of Hall field and obtain an expression for the Hall coefficient and carrier concentration of an n-type semiconductor.	10	L3	5
	c)	Mobilities of electrons and holes in a sample of intrinsic germanium at 300 K are $0.36\ m^2V^{-1}s^{-1}$ and $0.17\ m^2V^{-1}s^{-1}$ respectively. If the resistivity of the specimen is 2.12 Ωm, compute the intrinsic carrier density.	4	L3	5

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

****

USN

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 2019

18PH102/17PH102 – ENGINEERING PHYSICS

ration: 3 Hours | Max. Marks: 100

t of constants: Velocity of light, $c = 3 \times 10^8\ ms^{-1}$, Planck's constant, $h = 6.63 \times 10^{-34}$ Js,
Electron mass, $m=9.11\times10^{-31}$ kg, Electron charge, $e=1.6\times10^{-19}$ C,
Boltzmann constant, $k=1.38\times10^{-23}$ J/K,
Avogadro number, $N_A = 6.023\times 10^{26}$ / kg mole.

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

		Marks	BT*	CO*	PO*
	Unit – I				
a)	What is a wave function? Mention characteristics of wave function.	6	L*1	1	1
b)	Derive time independent Schrödinger's wave equation for a particle of mass m with energy E moving in one dimension.	10	L2	1	1,2
c)	An electron is bound in a one dimensional potential well of width 1 Å, but of infinite wall height. Find its energy values in the ground state and also in the first two excited states.	4	L3	1	1,2
a)	Explain the terms a) Phase velocity b) Group velocity and c) Probability density.	6	L1	1	1
b)	What are eigen values and eigen functions? Using Schrödinger's wave equation for a particle in one dimension potential well of infinite height discuss wave functions, energy levels and probability densities.	10	L2	1	1,2
c)	Calculate the momentum and de Broglie wavelength associated with an electron subjected to a potential difference of 1.5 kV	4	L3	1	1,2
	Unit – II				
a)	What is inter planar distance? Derive an expression for inter planar spacing in terms of lattice parameters and Miller indices for a cubic crystal.	6	L2	2	1,2
b)	What is atomic packing factor? Determine the atomic packing factor for simple cubic and face centered cubic (FCC) lattice by calculating number of atoms/unit cell and obtaining the relation between atomic radius and lattice constant.	10	L3	2	1,2
c)	In an x-ray diffraction experiment, the first order diffraction from a particular set of planes was observed at 12°. Find the angle at which the second order diffraction occurs for the same set of planes.	4	L3	2	1,2
a)	Describe the crystal structure of sodium chloride. Write down the positional coordinates of all ions in the unit cell.	6	L2	2	1,2
b)	What are X-rays? Mention its properties. With necessary diagrams, explain the origin of continuous X-rays.	10	L2	2	1,2
c)	Iron crystallizes in BCC structure. Calculate the lattice constant. Given that, the atomic weight of iron is 55.85 and density of iron is 7860 kg/m^3.	4	L3	2	1,2
	Unit – III				
a)	Explain the terms (a) Stimulated emission, (b) Metastable state and (c) Population inversion.	6	L1	3	1
b)	Describe the construction and working of a He-Ne laser with necessary diagrams.	10	L3	3	1

P.T.O.

	c)	A uniform wire has a resistivity of 2×10^{-8} Ωm at room temperature. For an electric field of 200 V/m along the wire compute the average drift velocity of the electrons assuming a carrier concentration of 6×10^{28} m^{-3}. Also calculate the mobility of electrons.	4	L3	3
6.	a)	What is superconductivity? Explain the important characteristic properties of superconductors.	6	L1,L2	3
	b)	Explain in detail Type-I and Type-II superconductor. Mention the any four applications of superconductors.	10	L1,L2	3
	c)	Calculate the probability of occupation of an electron occupying an energy level 0.02 eV above the Fermi level at 200 K.	4	L3	3
		Unit – IV			
7.	a)	Explain the effect of temperature on the Fermi level in an extrinsic semiconductor?	6	L2	4
	b)	What is Hall effect? Explain the generation of Hall field in the semiconductor. Obtain expressions for carrier concentration and Hall coefficient.	10	L1,L2	4
	c)	Calculate the resistivity of intrinsic germanium if the intrinsic carrier density is 2.5×10^{19} m^{-3} assuming electron and hole mobilities of 0.38 $m^2V^{-1}s^{-1}$ and 0.18 $m^2V^{-1}s^{-1}$ respectively.	4	L3	4
8.	a)	Give any four differences between junction diodes and zener diodes.	6	L1,L2	4
	b)	With the help of energy level diagrams, explain the formation of a potential barrier in a p-n junction. Explain the effect of forward biasing and reverse biasing in a p-n junction diode.	10	L1,L2	4
	c)	The electrical conductivity of an intrinsic semiconductor increases from 19.96 $ohm^{-1}m^{-1}$ to 79.44 $ohm^{-1}m^{-1}$ when the temperature is increased from 60 °C to 100 °C. Find the band gap energy of the semiconductor.	4	L3	4
		Unit – V			
9.	a)	With neat energy level diagrams, explain induced absorption, spontaneous emission and stimulated emission.	6	L2	5
	b)	Explain the construction and working of a He-Ne laser with neat diagrams.	10	L2	5
	c)	A He-Ne laser emits light at a wavelength of 632.8 nm and has an output power of 5 mW. How many photons are emitted in each second by this laser?	4	L3	5
10.	a)	Explain i) Luminescence ii) population inversion and iii) optical fiber.	6	L2	5
	b)	Explain the different types of optical fibers.	10	L2	5
	c)	Calculate the numerical aperture and hence the acceptance angle for an optical fiber whose core and cladding has refractive index of 1.45 and 1.40 respectively.	4	L3	5

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

****

USN

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

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

November - December 2019

19PH102 – ENGINEERING PHYSICS

uration: 3 Hours | Max. Marks: 100

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

st 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,
Boltzmann constant, $k=1.38\times10^{-23}$J/K. Avogadro number, $N_A = 6.022 \times 10^{26}$/ kg mole.

		Unit – I	Marks	BT*	CO*	PO*
	a)	What is a wave function? Write the conditions for valid wave functions.	6	L*1	1	1,2
	b)	Derive Schrodinger's time independent one dimensional wave equation for a particle of mass m with energy E.	10	L2	1	1,2
	c)	Find the de Broglie wavelength associated with an electron travelling with a velocity 10^6 m/s.	4	L3	1	1,2
	a)	Explain a) Matter waves b) Phase velocity and c) Group velocity	6	L1,L2	1	1,2
	b)	Using Schrodinger's wave equation for a particle in one dimensional potential well of infinite height discuss wave functions, energy levels and probability densities.	10	L2	1	1,2
	c)	An electron is trapped in a one dimensional region of length 4 Å. How much energy must be supplied to excite the electron from the ground level to the second excited state?	4	L3	1	1,2
		Unit – II				
	a)	What is a unit cell? With neat diagrams, explain any three crystal systems with lattice parameters.	6	L1,L2	2	1,2
	b)	Define primitive unit cell, non - primitive unit cell and inter planar distance. Derive an expression for inter planar distance in terms of lattice parameter and Miller indices for the case of a cubic crystal.	10	L1,L2	2	1,2
	c)	The interplanar spacing of (110) planes is 2Å for a FCC crystal. Find out the atomic radius.	4	L3	2	1,2
	a)	What are x-rays? Explain the production of x-rays.	6	L1,L2	2	1,2
	b)	Define coordination number and atomic packing factor. Determine the atomic packing factor for the case of face centered cubic (FCC) lattice by calculating number of atoms/unit cell and obtaining relation between atomic radius and lattice constant.	10	L1,L2	2	1,2
	c)	First order spectrum is formed when x-rays of wavelength 1.5 Å is incident on a crystal at an angle 12°. Calculate the interplanar spacing of the crystal.	4	L3	2	1,2
		Unit – III				
	a)	What is a free electron? Explain the free electron concept of conductors with example on the basis of classical free electron theory.	6	L1,L2	3	1,2
	b)	Derive an expression for the conductivity of metals on the basis of classical free electron theory.	10	L2	3	1,2

P.T.O.