NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

II Sem B.E. (Credit System) Mid Semester Examinations - II, March 2017

16PH102 – ENGINEERING PHYSICS

Duration: 1 Hour

Max. Marks: 20

*Note: Answer any **One** full question from **each Unit.***

List of constants: Velocity of light, $c = 3 \times 10^8 ms^{-1}$, 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, $\varepsilon_o = 8.85 \times 10^{-12}$ F/m, Boltzmann constant, $k=1.38 \times 10^{-23}$ J/K

			Marks	BT*
		Unit – I		
1.	a)	What are the assumption of classical free electron theory. Explain the effect of temperature on the electrical resistivity of metals.	3	L*2
	b)	Obtain an expression for the electrical conductivity of a metal based on classical free electron theory.	4	L4
	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.	3	L3
2.	a)	What is Hall effect? Explain how Hall field is produced. Mention the applications of Hall effect.	3	L2
	b)	What are intrinsic and extrinsic semiconductors? Describe the mechanisms of carrier generation in extrinsic semiconductors.	4	L3
	c)	Find the temperature at which there is 2% probability that an energy level 0.2 eV above Fermi level being occupied?	3	L3
		Unit – II		
3.	a)	Describe an optical fiber? What is the principle based on which optical transmission is achieved through a fiber? Explain.	3	L2
	b)	With necessary diagrams explain construction and working of He-Ne laser.	4	L3
	c)	A He- Ne laser emits light at a wavelength of 632.8 nm and has an output power of 2.3 mW. How many photons are emitted in each minute by this laser?	3	L3
4.	a)	Explain spontaneous emission. Why it is not desired for lasing action?	3	L2
	b)	Explain the ray propagation through an optical fiber and angle of acceptance. Obtain the expression for numerical aperture in terms of refractive indices of core and cladding.	4	L3
	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 0.005. Find (a) the acceptance angle (b) the numerical aperture and (c) the critical internal reflection angle.	3	L3

BT* Bloom's Taxonomy, L* Level

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II Sem B.E. (Credit System) Mid Semester Examinations - I, February 2017

16PH102 – ENGINEERING PHYSICS

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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, $N_A = 6.023 \times 10^{26}$/ kg mole.

			Marks	BT*
		Unit – I		
1.	a)	What are matter waves? Mention their characteristics.	3	L*2
	b)	What is a wave function? Derive Schrodinger's time independent wave equation in one dimension for a particle of mass m with energy E.	4	L3
	c)	Calculate the de Broglie wavelength associated with an electron with a kinetic energy of 2 keV.	3	L4
2.	a)	Define group velocity. Obtain an expression for the same.	3	L2
	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.	4	L3
	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.	3	L4
		Unit – II		
3.	a)	What is inter planar distance? Obtain an expression in terms of lattice parameter and miller indices for the case of a cubic crystal.	3	L2
	b)	Describe the crystal structures of sodium chloride and zinc sulphide.	4	L3
	c)	Copper has FCC structure of atomic radius 0.1278 nm. Calculate the inter planar spacing for (3 2 1) plane.	3	L4
4.	a)	What are X-rays? Explain the origin of continuous X ray spectrum.	3	L2
	b)	What is atomic packing factor? Determine the atomic packing factor for body centered cubic lattices by calculating number of atoms per unit cell and atomic radius.	4	L3
	c)	Draw the following planes: (1 1 0), (3 2 1) and ($\bar{1}$ 1 1) in a cubic unit cell.	3	L4

BT* Bloom's Taxonomy, L* Level

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I Sem B.E. (Credit System) Mid Semester Examinations - II, October 2017

17PH102 – ENGINEERING PHYSICS

Duration: 1 Hour | Max. Marks: 20

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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. Avogadro number = 6.023×10^{26}/ k mol

		Marks	BT*
	Unit – I		
1. a)	What is Matthiessen's rule? Explain in detail.	3	L*2
b)	Derive an expression for electrical conductivity based on free electron theory.	4	L2
c)	What is the drift velocity of conduction electrons in a copper wire of cross section area 1×10^{-6} m^2 when a current of 2A flows through it? Assume the electron density as equal to 8.5×10^{28} /m^3.	3	L3
2. a)	What is Hall effect? Explain the formation of Hall field in a semiconductor.	3	L2
b)	What is an intrinsic semiconductor? Obtain an expression for the conductivity of an intrinsic semiconductor.	4	L2
c)	A sample of silicon semiconductor is doped with 10^{22} phosphorous atoms. Calculate its conductivity if mobility of electrons is 0.07 m^2/Vs. What is the Hall voltage if this semiconductor with a thickness of 100μm and carrying a current of 1mA is placed perpendicular to a magnetic field of 0.1T.	3	L3
	Unit – II		
3. a)	Distinguish between spontaneous emission and stimulated emission.	3	L4
b)	Describe the construction and working of Ruby laser.	4	L2
c)	Find the ratio of population of two energy states, the transition between which is responsible for the emission of photons of wavelength 694.3nm at temperature 300 K.	3	L3
4. a)	What is a laser? Explain its properties.	3	L1
b)	What are the conditions required for good lasing action? Explain	4	L2
c)	A laser emits light of at a wavelength of 632.8 nm and has an output power of 5mW. How many photons are emitted each second by this laser	3	L3

BT* Bloom's Taxonomy, L* Level

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