CBCS SCHEME

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BPHYE102/202

First/Second Semester B.E./B.Tech.Degree Examination, June/July 2023
Applied Physics for EEE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	What is Wave function? Setup Time Independent Schrodinger wave equation for a Quantum free particle in one dimension and mention the same in three dimensions.	9	L2	CO1
	b.	Explain de-Broglie hypothesis. Arrive at the expression for de-Broglie wavelength.	6	L2	CO1
	c.	Calculate the energy in first two energy states for an electron in one dimensional infinite potential well of width 1 nm.	5	L3	CO1
		OR			
Q.2	a.	Starting from Schrodinger Time Independent wave equation, obtain the expressions for Energy Eigen values and normalized Eigen wave function for a particle in one dimensional infinite potential well.	9	L2	CO1
	b.	State and explain Heisenberg's uncertainty principle. Using the same, show the non-existence of electron inside the nucleus.	6	L2	CO1
	c.	An electron and a photon each have same de-Broglie wavelength of $10\,\mathring{A}$. Find the kinetic energy of electron and energy of photon.	5	L3	CO1
		Module – 2			
Q.3	a.	Define superconductivity and critical temperature. Explain briefly SQUID and mention its any three applications.	10	L2	CO2
	b.	Mention the expression for internal field for one dimensional array of atoms in case of solid dielectrics. Derive Clausius Mossotti equation.	6	L2	CO2
	c.	Evaluate the probability of an electron occupying an energy level 0.02 eV above the Fermi level at 400 K.	4	L3	CO2
		OR			
Q.4	a.	Explain Electronic, Ionic and Orientation polarizations of dielectrics. Outline briefly the solid and liquid dielectrics with one example each.	10	L2	CO2
	b.	Give any four assumptions of quantum free electron theory. Mention the expression for electrical conductivity in metals and explain the symbols.	6	L2	CO2
	c.	Lead in the superconducting state has critical temperature of 6.2 K at zero magnetic field and a critical field of $0.064\ MAm^{-1}$ at 0 K. Determine the critical field at 4 K.	4	L3	CO2
		Module – 3			
Q.5	a.	Mention any four characteristics of LASER and explain three types of interaction of radiation with matter.	10	L2	CO1

	b.	With a neat labelled block diagram, explain the application of optical fibers in point to point communication.	6	L2	CO1
	c.	A medium in thermal equilibrium at 300 K has two energy levels with wavelength separation 1 μm. Find the population densities ratio of upper and lower energy levels.	4	L3	CO1
		OR			
Q.6	a.	Derive an expression for numerical aperture of an optical fiber. Discuss step-index single mode and multi mode optical fibers.	10	L2	CO1
	b.	Discuss the application of laser in laser range finder in Defence.	6	L2	CO1
	c.	The sum of refractive indices of core and cladding in a step index optical fiber is 3.12 and their difference is 0.08. The diameter of core is 50 μm. Find the V-number and number of modes that the fiber can support for propagation at the wavelength 594 nm.	4	L3	CO1
		Module – 4			
Q.7	a.	Write Maxwell's equations in vacuum. Drive equation of electromagnetic waves using Maxwell's equation in free space.	8	L2	CO3
	b.	State and derive Gauss divergence theorem. Mention Stoke's theorem in mathematical form.	7	L2	CO3
	c.	Find the resonance frequency of an LCR series circuit with inductance = 0.5 henry, capacitance = 0.45 microfarad and resistance = 400 ohm.	5	L3	CO5
		OR			
Q.8	a.	State and explain : Gauss law in magnetism, Ampere's circuital law and Biot-Savart's law.	8	L2	CO3
	b.	Discuss continuity equation. Derive an expression for displacement current.	7	L2	CO3
	c.	Find the wavelength of the semiconductor laser in the diffraction grating experiment when the angle of diffraction is 1.5 degree for the second order maximum. Given grating constant = 4.7×10^{-5} per metre.	5	L3	CO5
		Module – 5			
Q.9	a.	State and explain law of mass action for semiconductors. Derive the expression for Fermi energy interms of energy gap of intrinsic semiconductor.	10	L2	CO4
	b.	Describe the construction and working of semiconductor laser diode.	6	L2	CO4
	c.	The concentration of electrons at room temperature in an extrinsic semiconductor used in Hall experiment is $1.7 \times 10^{29} / m^3$. If a current of 100 A flows through the semiconducting strip of thickness 1 mm and the strength of magnetic field perpendicular to the strip is 3.6 wb/m^2, estimate the Hall coefficient and Hall voltage.	4	L3	CO4
		OR			
Q.10	a.	What is Hall effect? Derive an expression for Hall voltage in terms of Hall coefficient. Mention any three applications of Hall effect.	10	L2	CO4
	b.	Explain Four probe method to determine resistivity of semiconductor.	6	L2	CO4
	c.	Mobilities of electrons and holes in a sample of intrinsic Germanium at 300 K are 0.36 $m^2V^{-1}s^{-1}$ and 0.14 $m^2V^{-1}s^{-1}$ respectively. If the resistivity of Ge is 2.5 Ω m, compute the intrinsic carrier density.	4	L3	CO4

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