CBCS SCHEME

First/Second Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024
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.	Obtain the expression for Eigen value and Eigen function for a particle in one dimensional potential well of infinite height.	10	L2	CO1
	b.	What is Wave function? Give its physical significance and properties.	6	L2	CO1
	c.	An electron is bound in an one dimensional potential well of width 1A° and of infinite height. Find its energy values in eV in the ground state and first two excited states.	4	L3	CO1
		OR			
Q.2	a.	State and explain Heisenberg's uncertainty principle. Show that an electron does not exist inside the nucleus on the basis of Heisenberg's uncertainty principle.	10	L2	CO1
	b.	What is wave function, probability density and normalization of wave function.	6	L2	CO1
	c.	Calculate the de Broglie wavelength associated with an electron having a kinetic energy of 100eV.	4	L3	CO1
		Module – 2			
Q.3	a.	Describe Type I and Type II superconductors. Explain construction and working of MAGLEV vehicle.	10	L2	CO2
	b.	Derive Clausius Mossotti equation.	6	L2	CO2
	c.	Show that the sum of the probability of occupancy of an energy state of ΔE below Fermi level and that at ΔE above Fermi level is unity.	4	L3	CO2
		OR			
Q.4	a.	Discuss the probability of occupation of various energy states by electrons at T = 0K and T > 0K on the hosis of fermi factor.	10	L2	CO2
	b.	Describe different types of polarization mechanisms in dielectric materials.	6	L2	CO2

	c.	If NaCl crystal is subjected to an electric field of 1000V/m and the resulting polarization is $4.3 \times 10^{-8} c/m^2$. Calculate dielectric constant of NaCl.	4	L3	CO2

Module – 3

Q.5	a.	What is numerical aperture? Obtain an expression for numerical aperture of optical fiber.	8	L2	CO3
	b.	Describe the construction and working of carbon dioxide laser with energy level diagram.	8	L2	CO3
	c.	In a diffraction grating experiment with a semiconductor laser, the grating constant is 4.7×10^{-5} per metre. If the angle of diffraction for the second order is 1.5 degree, find the wavelength of the laser.	4	L3	CO5

OR

Q.6	a.	Obtain an expression for energy density of radiation under thermal equilibrium condition interms of Einstein's coefficients.	10	L2	CO3
	b.	Explain different types of attenuations of fibers.	6	L2	CO3
	c.	Determine the resonance frequency of an LCR series circuit with inductance = 0.5H, capacitance = 0.45 microfarad and resistance $300 = \Omega$.	4	L3	CO5

Module – 4

Q.7	a.	Derive wave equation for electromagnetic waves in vacuum in terms of electric field using Maxwell's equation.	9	L2	CO4
	b.	Explain the terms gradient of scalar, divergence and curl of a vector.	6	L2	CO4
	c.	Prove that $3y^4 z^2 \hat{a}_x + 4x^3 z^2 \hat{a}_y + 3x^2 y^2 \hat{a}_z$ is solenoidal.	5	L3	CO4

OR

Q.8	a.	State and prove Gauss Divergence theorem.	7	L2	CO4
	b.	Explain Faraday's law of electromagnetic induction. Express the same in the point form of Maxwell's equation.	8	L2	CO4
	c.	Find the divergence of the vector field $\vec{A}$ given by $\vec{A} = 6x^2 \hat{a}_x + 3xy^2 \hat{a}_z + xyz^3 \hat{a}_z$.	5	L3	CO4

Module – 5

Q.9	a.	What is Hall effect? Obtain an expression for the Hall coefficient in terms of Hall voltage.	8	L2	CO5
	b.	Explain the construction and working of photodiode. Define the power responsivity in a photodiode.	8	L2	CO5
	c.	The resistivity of intrinsic Germanium at 27°C is equal to 0.47 ohm-meter. Assuming electron and hole mobilities are $0.38 m^2 v^{-1} s^{-1}$ and $0.18 m^2 v^{-1} s^{-1}$ respectively. Calculate the intrinsic carrier density.	4	L3	CO5

		OR			
Q.10	a.	Establish relation between Fermi energy and energy gap for an intrinsic semi conductor.	8	L2	CO5
	b.	Derive expression for electrical conductivity in extrinsic and intrinsic semiconductors.	8	L2	CO5
	c.	The following data are given for intrinsic Germanium at 300K, $n_i = 2.4 \times 10^{19}/m^3$, $\mu_e = 0.39 m^2 v^{-1} s^{-1}$, $\mu_h = 0.19 m^2 v^{-1} s^{-1}$. Calculate the resistivity of the sample.	4	L3	CO5

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