CBCS SCHEME

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BPHYE102/202

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 4.3×10^{-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 = Ω.	**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 $3y^4z^2\hat{a}_x + 4x^3z^2\hat{a}_y + 3x^2y^2\hat{a}_z$ 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 $0.38 m^2v^{-1}s^{-1}$ and $0.18 m^2v^{-1}s^{-1}$ 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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