MAKE-UP EXAM

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BPHYE102/202

First/Second Semester B.E./B.Tech. Degree Examination, Nov./Dec. 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.**	State Heisenberg's uncertainty principle. Show that an electron does not exist inside the nucleus on the basis of Heisenberg's uncertainty principle.	7	L2	CO1
	b.	Starting from Schrodinger's time independent wave equation, derive the expression for energy eigen value and eigen function for an electron in one dimensional potential well of infinite height.	8	L2	CO1
	c.	A particle of mass 0.5 MeV/c^2 has kinetic energy 100eV. Find its de Broglie wavelength, where C is the velocity of light.	5	L3	CO1
		OR			
Q.2	**a.**	Set up time independent Schrödinger wave equation for a free particle in one dimension.	7	L2	CO1
	b.	Explain probability density and normalization. Give the physical significance of a wave function.	8	L2	CO1
	c.	In a measurement that involved an inherent uncertainty of 0.003%, the speed of an electron was found to be 800m/s. Calculate the corresponding uncertainty involved in determining its position.	5	L3	CO1
		Module – 2			
Q.3	**a.**	Explain polarization of dielectric. Discuss the mechanism of different types of polarization.	9	L2	CO1
	b.	Describe the type I and type II superconductors.	6	L2	CO1
	c.	Find the temperature at which there is 1% probability that a state with an energy 0.5eV above Fermi energy is occupied.	5	L3	CO1
		OR			
Q.4	**a.**	Mention any two assumption of quantum fee theory? Discuss the probability of occupation of various energy states by electron on temperature on the basis of Fermi factor.	9	L2	CO1
	b.	Explain the construction and working of Maglev vehicles.	6	L2	CO1

	c.	The dielectric constant of Helium gas at NTP is 1.0000684. Calculate the electronic polarizability of the atoms if Helium gas contains 2.7×10^{25} atoms/m^3 and kept in an electric field of 3×10^4V/m.	**5**	**L3**	**CO1**
		Module – 3			
Q.5	**a.**	Obtain an expression for energy density of radiation under thermal equilibrium condition in terms of Einstein's co-efficient.	**8**	**L2**	**CO2**
	b.	What is attenuation? Discuss different types of attenuation in optical fiber.	**7**	**L2**	**CO2**
	c.	The ratio of population of upper to lower energy levels is 1.059×10^{-30}. Find the wave length of light emitted by spontaneous emission at 300K.	**5**	**L3**	**CO2**
		OR			
Q.6	**a.**	Define Numerical aperture. Obtain an expression for numerical aperture in an optical fiber.	**8**	**L2**	**CO2**
	b.	Describe the principle, construction and working of carbon dioxide laser with energy level diagram.	**7**	**L2**	**CO2**
	c.	In a step index optical fiber with a core diameter of 60μm and core and cladding refractive indices as 1.5 and 1.48 respectively. When the wavelength of 850nm is propagating through it. Calculate the numerical aperture, fractional index change, V-parameter and number of modes in the fiber.	**5**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	Discuss about continuity equation. Derive the expression for displacement current.	**8**	**L2**	**CO3**
	b.	Explain Faraday's law of Electromagnetic induction, Amperes law and express the same in point form.	**7**	**L2**	**CO3**
	c.	Determine the constant 'C' such that, the vector $\vec{A} = (x + ay)\hat{a}_x + (y + bz)\hat{a}_y + (x + cz)\hat{a}_z$ is solenoidal.	**5**	**L3**	**CO3**
		OR			
Q.8	**a.**	Derive wave equation for electromagnetic waves in vacuum in terms of electric field using Maxwell's equation.	**8**	**L2**	**CO3**
	b.	What are vector operator ∇ and explain the concept of divergence, gradient and curl.	**7**	**L2**	**CO3**
	c.	Calculate the curl of $\vec{A}$, given $\vec{A} = (1 + yz^2)\hat{a}_x + xy^2\hat{a}_y + x^2y\hat{a}_z$	**5**	**L3**	**CO3**

		Module – 5			
Q.9	**a.**	Discuss the law of mass action. Establish relation between Fermi energy and energy gap for an intrinsic semiconductor.	**8**	**L2**	**CO4**
	b.	Define Hall voltage and Hall field? Obtain expression for Hall voltage in term of Hall co-efficient.	**7**	**L2**	**CO4**
	c.	The resistivity of intrinsic germanium at 27ºC is equal to 0.47 ohm-meter. Assuming electron and hole mobilities as $0.38 m^2V^{-1}s^{-1}$ and $0.18 m^2V^{-1}S^{-1}$ respectively. Calculate the intrinsic carrier density.	**5**	**L3**	**CO4**
		OR			
Q.10	**a.**	Derive an expression for electrical conductivity in extrinsic and intrinsic semiconductor.	**8**	**L2**	**CO4**
	b.	Explain the construction and working of photo transistor and also mention any two applications.	**7**	**L2**	**CO4**
	c.	In diffraction gravity experiment the laser light undergoes second order diffraction for diffraction angle 1.48º. The grating constant $d = 5.05 \times 10^{-5}$m and the distance between the grating and screen is 0.60m. Calculate the wavelength of laser source.	**5**	**L3**	**CO5**

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