U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: I / II**
Branch: Electrical Stream **Duration: 3 hrs.**
Course Code: 22PH1BSPEE / 22PH2BSPEE **Max Marks: 100**
Course: Applied Physics for Electrical Stream

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Physical constants:

Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg
Electronic charge, $e = 1.602 \times 10^{-19}$ C
Boltzmann constant, $k_B = 1.38 \times 10^{-23}$ J/K
Permittivity of free space$=8.85 \times 10^{-12}$ F/m
Speed of light, $c = 3 \times 10^8$ m/s
Planck constant, $h = 6.626 \times 10^{-34}$ Js
Mass of neutron, $m_n = 1.67 \times 10^{-27}$ kg
Mass of proton, $m_p = 1.67 \times 10^{-27}$ kg

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		MODULE - I	*CO*	*PO*	Marks
1	a)	Obtain Schrodinger's wave equation for a particle in one-dimensional infinitely deep potential well and solve to find the normalized wave function	CO1	PO1	**8**
	b)	State Heisenberg's uncertainty principle. Using this principle show that, a free electron does not exist inside the nucleus of an atom.	CO1	PO1	**8**
	c)	Calculate the momentum and de-Broglie wavelength associated with an electron having kinetic energy 1.5 keV.	CO1	PO2	**4**
		OR			
2	a)	Set up time-independent Schrodinger's wave equation and explain Eigen function and Eigen values.	CO1	PO1	**8**
	b)	Define Phase velocity and Group velocity. Derive the relation between group velocity and particle velocity.	CO1	PO1	**8**
	c)	The position and momentum of an electron with energy 1 keV are simultaneously determined. If the inherent uncertainty in the measurement of its position is 1 Å, what is the minimum percentage of uncertainty in its momentum.	CO1	PO2	**4**
		MODULE - II			
3	a)	Describe the construction and working of a He-Ne laser with the help of energy level diagram.	CO1	PO1	**8**
	b)	Define numerical aperture. Derive an expression for numerical aperture of an optical fiber and arrive at the condition for light propagation.	CO1	PO1	**8**

		c)	The average output power of laser source emitting a laser beam of wavelength 6328 Å is 5mW. Find the number of photons emitted per second by the laser source.	CO1	PO2	**4**
			OR			
	4	a)	Obtain an expression for energy density of radiation under thermal equilibrium condition in terms of Einstein's coefficients.	CO1	PO1	**8**
		b)	Describe point to point communication system using optical fibers with the help of a block diagram and mention its advantages over the conventional communication systems.	CO1	PO1	**8**
		c)	Calculate the numerical aperture, fractional index change and V-number for a fiber of core diameter 40μm and with refractive indices of 1.55 and 1.50 respectively for core and cladding. The wavelength of the propagating wave is 1400 nm. Assume that the fiber is in air.	CO1	PO2	**4**
			MODULE -III			
	5	a)	Mention the assumptions of quantum free electron theory and explain any two merits of quantum free electron theory.	CO1	PO1	**8**
		b)	What is polarization? Explain any three types of polarization in dielectric materials.	CO1	PO1	**8**
		c)	Calculate the probability of an electron occupying an energy level 0.02 eV above the Fermi level and 0.02 eV below the Fermi level at 200 K.	CO1	PO2	**4**
			MODULE - IV			
	6	a)	Explain the phenomenon of Hall Effect in semiconductors and obtain suitable expression for Hall voltage.	CO1	PO1	**8**
		b)	Describe the construction and working of semiconducting diode laser.	CO1	PO1	**8**
		c)	The intrinsic carrier density of semiconductor is 2.1 x 10^{19} /m^3, the electron and hole mobilities are 0.4 and 0.2 m^2/Vs respectively. Calculate the conductivity.	CO1	PO2	**4**
			MODULE - V			
	7	a)	What is superconductor? Describe type I and Type II superconductors with M-H graph.	CO1	PO1	**8**
		b)	Explain the Wiess's domain theory of ferromagnetic materials and explain in brief the hysteresis using it.	CO1	PO1	**8**
		c)	The critical field for niobium is 1×10^5 A/m at 8 K and 2×10^5 A/m at absolute zero. Find the transition temperature of the element.	CO1	PO2	**4**

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