U.S.N.										

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

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main 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 Engineering Stream **Date: 30.09.2023**

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.

			CO	PO	Marks
		MODULE - I			
1	a)	Set up one-dimensional time-independent Schrodinger's wave equation.	CO1	PO1	**8**
	b)	Define group velocity and phase velocity. Derive the relation between them in terms of wavelength.	CO1	PO1	**8**
	c)	The ground state energy of an electron in an infinite well is 5.6 meV. If the width of the well is doubled, what are the ground state and first excited state energies?	CO1	PO2	**4**
		OR			
2	a)	Starting with the normalized wave function, discuss in detail the Eigen function, Eigen value and probability function for ground state and first excited state with suitable graphs.	CO1	PO1	**8**
	b)	State Heisenberg's uncertainty principle. Using this principle prove that an electron does not exist inside the nucleus.	CO1	PO1	**8**
	c)	The position and momentum of 1 keV electron are simultaneously determined and if its position is located within 1 Å, what is the percentage of uncertainty in momentum?	CO1	PO2	**4**
		MODULE - II			
3	a)	Describe the construction and working of He-Ne LASER with an energy level diagram.	CO1	PO1	**8**
	b)	Derive an expression for the numerical aperture of an optical fiber and arrive at the condition for propagation.	CO1	PO1	**8**
	c)	Optical fiber is found to have 15% signal losses due to scattering and absorption of the total signal strength. If the input signal	CO1	PO2	**4**

			strength is 10 W and the co-efficient of attenuation is 6 dB/km. Find the length of the optical fiber.			
			OR			
	4	a)	Derive the expression for energy density of radiation in terms of Einstein's coefficients under thermal equilibrium.	CO1	PO1	**8**
		b)	What is attenuation? Explain the application of optical fibers in point to point communication system with a neat block diagram.	CO1	PO1	**8**
		c)	Determine the temperature at which the wavelength of light emitted is 632.8 nm. The ratio of population of two energy levels is $1.03x10^{30}$.	CO1	PO2	**4**
			MODULE - III			
	5	a)	Define Fermi factor and explain its dependence on energy and temperature with suitable graph.	CO1	PO1	**8**
		b)	What is polarization in dielectric materials? Discuss any three types of polarizations.	CO1	PO1	**8**
		c)	The Fermi level in silver is 5.4 eV at 0K. Calculate the number of free electrons per unit volume and the probability of occupancy for electrons with energy 5.7 eV in silver at the same temperature.	CO1	PO2	**4**
			MODULE - IV			
	6	a)	What is Hall Effect? Obtain the expression for Hall voltage in terms of Hall coefficient.	CO1	PO1	**8**
		b)	Describe the construction and working of semiconducting diode LASER with energy level diagram.	CO1	PO1	**8**
		c)	A copper strip 1 cm width and 1 mm thick placed in a magnetic field of strength 1.5 wb/m^2. If a current of 200 A setup in the strip, calculate the Hall voltage that appears across the strip. Given, $R_H = 6 \times 10^{-7}\ m^3/C$.	CO1	PO2	**4**
			MODULE - V			
	7	a)	What is superconductivity? Describe type I and Type II superconductors with M-H graph.	CO1	PO1	**8**
		b)	What is Meissner effect? Explain High-Temperature superconductivity with examples.	CO1	PO1	**8**
		c)	A superconductor has a critical temperature of 4.7 K in zero magnetic field and a critical field of 0.036 tesla at 0 K. Find the critical field at 2.5 K.	CO1	PO2	**4**

****