U.S.N.										

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

Autonomous Institute Affiliated to VTU

February / March 2024 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 Stream

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

Physical constants:

Mass of electron, $m_e = 9.1\times10^{-31}$ kg
Electronic charge, $e = 1.602\times10^{-19}$ C
Boltzmann constant, $k_B = 1.38\times10^{-23}$ J/K
Permittivity of free space$=8.85\times10^{-12}$ F/m
Speed of light, $c = 3\times10^{8}$ m/s
Planck constant, $h = 6.626\times10^{-34}$ Js
Mass of neutron, $m_n = 1.67\times10^{-27}$ kg
Mass of proton, $m_p = 1.67\times10^{-27}$ 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)	What is wave function? Set up one-dimensional time independent Schrodinger wave equation for a quantum particle.	CO1	PO1	**8**
	b)	State Heisenberg's uncertainty principle. Using this principle show that, electrons cannot exist inside a nucleus of an atom.	CO1	PO1	**8**
	c)	A particle of mass 0.5 MeV/c^2 has kinetic energy 100 eV. Find its de -Broglie wavelength and group velocity, where c is the velocity of light.	CO1	PO2	**4**
		OR			
2	a)	Using Schrodinger wave equation, obtain an expression for the energy eigen values and eigen function for a particle in one-dimensional potential well of infinite height.	CO1	PO1	**8**
	b)	Define phase velocity and group velocity. Derive a relation between them in terms of wavelength.	CO1	PO1	**8**
	c)	Calculate the energy in eV for the ground state and first two excited states of an electron in an infinite potential well of width 1 Å.	CO1	PO2	**4**
		Module - II			
3	a)	Derive an expression for energy density of radiation in terms of Einstein's coefficients.	CO1	PO1	**8**
	b)	With the help of neat diagrams, explain the classification of optical fibers.	CO1	PO1	**8**
	c)	Find the ratio of population of two energy levels in a medium, the wavelength of light emitted at 330 K is 632.8 nm.	CO1	PO2	**4**

			OR			
	4	a)	Define numerical aperture. Obtain an expression for the numerical aperture of an optical fiber and hence arrive at the condition for ray propagation.	CO1	PO1	**8**
		b)	With suitable diagrams, explain the construction and working of He-Ne laser.	CO1	PO1	**8**
		c)	Find the attenuation in an optical fiber of length 500 m, when a light of signal of power 100 mW emerges out of the fiber with a power of 90 mW.	CO1	PO2	**4**
			Module - III			
	5	a)	Mention the postulates of quantum free electron theory and discuss any two of its merits.	CO1	PO1	**8**
		b)	What is polarization? Explain the various types of polarization mechanisms with suitable schematic diagram.	CO1	PO1	**8**
		c)	A solid dielectric material has polarizability of $7x10^{-40}$ Fm^2. Assuming the internal field to be Lorentz, calculate the dielectric constant for the material if the material has 3×10^{28} atoms/m^3.	CO1	PO2	**4**
			Module - IV			
	6	a)	Explain Hall effect. Derive an expression for Hall voltage and Hall coefficient.	CO1	PO1	**8**
		b)	Discuss the construction and working of semiconductor diode laser with neat diagram.	CO1	PO1	**8**
		c)	The resistivity of intrinsic Germanium at 27^0C is 0.47 Ωm. Assuming the 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.	CO1	PO2	**4**
			Module - V			
	7	a)	What are ferromagnetic materials? Explain Weiss domain theory of ferromagnetism.	CO1	PO1	**8**
		b)	Explain the Type-I and Type-II superconductors with M-H curve.	CO1	PO1	**8**
		c)	The critical temperature of Nb is 9.15 K. At zero kelvin, the critical field is 0.196 T. Calculate the critical field at 8 K.	CO1	PO2	**4**

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