U.S.N.										

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

Autonomous Institute Affiliated to VTU

September 2024 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, $m_e = 9.1\times10^{-31}$ 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)	Define phase velocity and group velocity. Derive the relation between them in a dispersive medium.	CO1	PO1	**08**
	b)	State Heisenberg's Uncertainty Principle (HUP). Discuss the non-existence of electron inside a nucleus using HUP.	CO1	PO1	**08**
	c)	An electron is bound in an one dimensional potential well of width 2 Å, but of infinite wall height. Find its energy values in the ground state and first excited state.	CO1	PO2	**04**
		OR			
2	a)	Set up one dimensional time independent Schrödinger's wave equation. Mention the three properties of wave function.	CO1	PO1	**08**
	b)	Explain de-Broglie hypothesis of matter wave. Derive the relation between group velocity and particle velocity.	CO1	PO1	**08**
	c)	In a measurement involving an uncertainty of 0.003%, the speed of an electron was found to be 800 m/s. Find the corresponding uncertainty involved in determining its position.	CO1	PO2	**04**
		Module - II			
3	a)	Derive an expression for the energy density of radiation under equilibrium conditions in terms of Einstein's coefficients.	CO1	PO1	**08**
	b)	With a neat block diagram explain point to point communication. Mention any four advantages of fibre optic communication.	CO1	PO1	**08**
	c)	Find the number of modes propagates through a multimode fiber of core index 1.55 and fractional index change 0.032, when the wavelength of the propagating wave is 1000 nm. (Given the radius of the fibre is 30 μm).	CO1	PO2	**04**

			OR			
	4	a)	With a neat label diagram, explain the construction and working of Helium-Neon laser.	*CO1*	*PO1*	**08**
		b)	What is refractive index profile of an optical fibre? With suitable diagrams, explain different types of optical fibres.	*CO1*	*PO1*	**08**
		c)	A pulsed laser emits photons of wavelength 694 nm with 20 mW average power/pulse. Find the number of photons contained in each pulse if the pulse duration is 10 ns.	*CO1*	*PO2*	**04**
			Module - III			
	5	a)	Explain the merits of quantum free electron theory. Describe any two major successes of quantum free electron theory.	*CO1*	*PO1*	**08**
		b)	With a neat diagram explain the polarization mechanisms in dielctrics.	*CO1*	*PO1*	**08**
		c)	Calculate the probability of an electron occupying an energy level 0.05 eV above and below the Fermi level at 300 K.	*CO1*	*PO2*	**04**
			Module - IV			
	6	a)	Arrive at an expression for electron concentration in conduction band of a semiconductor.	*CO1*	*PO1*	**08**
		b)	With a neat diagram, explain the construction and working of semiconductor diode laser.	*CO1*	*PO1*	**08**
		c)	The resistivity of intrinsic silicon at 300 K is 3000 Ωm. Assuming electron and hole mobilities as 0.17 m^2/v.s and 0.035 m^2/v.s respectively, calculate the intrinsic carrier concentration.	*CO1*	*PO2*	**04**
			Module - V			
	7	a)	What is magnetic hysteresis? With a neat graph, explain the Hysteresis using Weiss's domain theory.	*CO1*	*PO1*	**08**
		b)	Explain Meissner effect with a neat diagram. Write a note on high temperature superconductors.	*CO1*	*PO1*	**08**
		c)	The critical field of niobium is $1x10^5$ A/m at 8 K and $2x10^5$ A/m at 0 K. Find the transition temperature of the element.	*CO1*	*PO2*	**04**

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